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Definition of magnetic domains within the Rae Craton, mainland Canadian Shield, Nunavut, Northwest Territories, Saskatchewan, and Alberta: their magnetic signatures and relationship to geology

M.D. Thomas

2018

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Abstract

The Archean Rae craton, western Churchill Province, occupies a huge area within the northwestern mainland Canadian Shield. It extends >1600 km from the Talston magmatic zone northeastward to the east coast of Melville Peninsula, ranging in width from roughly 300 km to 900 km. The craton is covered by aeromagnetic data collected over many decades by Canada's National Aeromagnetic Survey Program, typically along lines 805 m apart at a flight elevation of 305 m. Additionally, many higher resolution aeromagnetic surveys have been completed during the last decade or so. The craton is geologically mapped at various scales, but most geological coverage is at a relatively large scale. For this reason magnetic data provided by the national program are considered to be of sufficient resolution to investigate relationships with geology.

Here, seventy-five magnetic domains are defined using textures, fabrics, patterns, orientations and intensities of residual total magnetic field anomalies and their derivative equivalents (first vertical derivative, tilt angle). Given that patterns and orientations of narrow derivative magnetic anomalies reflect closely geological structure, the magnetic domains can be viewed essentially as representative of structural domains. The maximum dimension of most domains is >100 km, but many attain dimensions of several 100 km. Although the Rae craton has an overall northeastward trend, a strong pattern of linear magnetic domains running parallel to this trend along the length of the craton is not apparent. A few generally relatively broad and parallel domains do run northeastward along the spine of the craton between roughly the Talston magmatic zone and Aberdeen sub-basin. Several narrower and typically less extensive domains also trend northeast within the Chesterfield block along the southeast margin of the craton southeast of the sub-basin. Where the southern part of the craton, south of the roughly east-trending Amer and Wager Bay shear zones, swings into a more eastward trend, linearity is lost and domains become smaller and more irregular in shape, with some trending across the craton.

The best developed linear pattern of domains probably lies between the Thelon magmatic zone and Chantrey fault zone, where several narrow to moderately wide, sub-parallel domains extend between the McDonald fault (and its northeastward projection) and Queen Maud Gulf. Eastward they change orientation progressively from northward to roughly N30^{O}E towards the fault zone. A sense of a linear arrangement of domains is observed also on the Boothia and Melville peninsulas, with trends varying between approximately east-northeast and northeast. A broad area east of the Chantrey fault zone, north of the Amer and Wager Bay shear zones, south of the Boothia Peninsula and including the southern part of the Melville Peninsula contains some linear domains trending approximately northeast, but there are also sizable domains of irregular shape lacking an internal magnetic fabric characterized by prominent northeast trends.

Many close correlations between magnetic anomalies and mapped lithological units exist, but there are numerous examples where anomalies transect unit boundaries thus questioning boundary positions. Magnetic anomalies indicate probable lithological/compositional changes within many large gneissic units pointing to a need for more detailed mapping. Many examples of exceptionally strong magnetic highs are associated with mapped iron formations. Such highs in areas apparently lacking iron formations signify their potential presence. Magnetic patterns and signatures outline locations of small circular to roughly oval, unmapped igneous intrusions, and many faults not displayed on geological maps.

Introduction

The Archean Rae craton forms the northwestern portion of the western Churchill province of the Canadian Shield. It extends approximately 2200 km northeastward from the western margin of the shield, between Great Slave Lake and Athabasca Lake, to the northeastern coast of Baffin Island (Fig. 1).

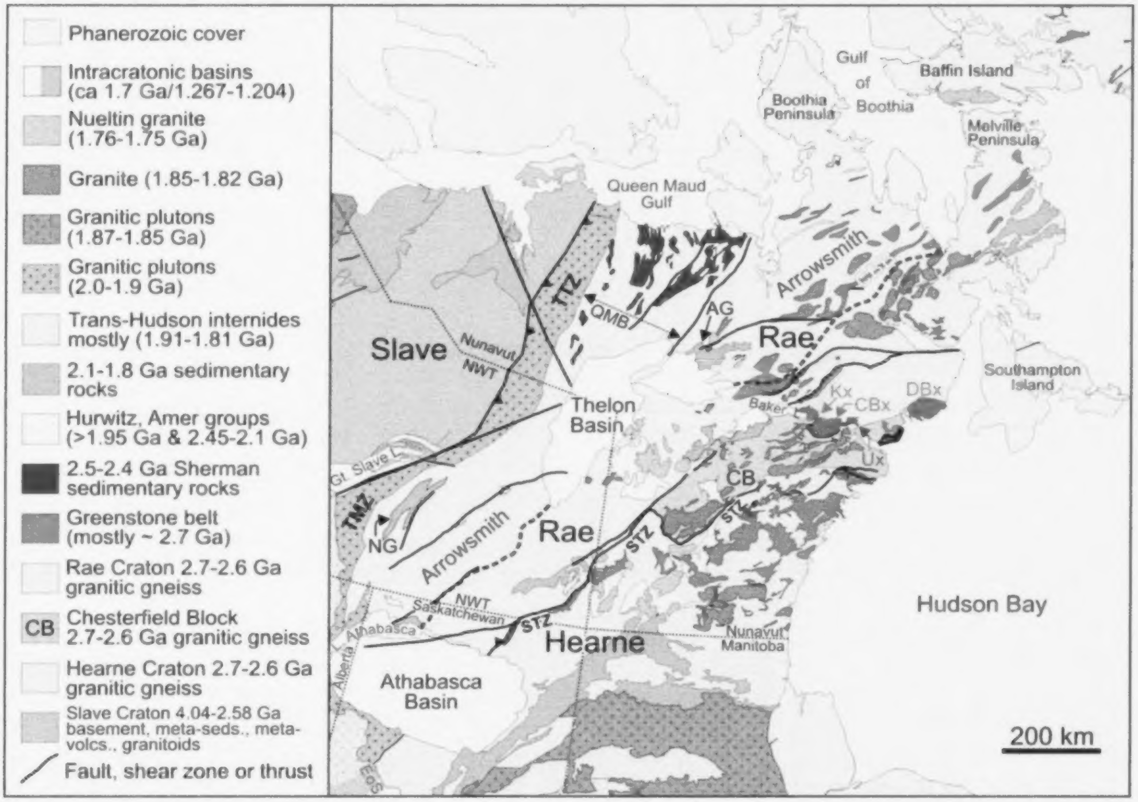
Phanerozoic cover
Intracratonic basins (ca 1.7 Ga/1.267-1.204)
Nueltin granite (1.76-1.75 Ga)
Granite (1.85-1.82 Ga)
Granitic plutons (1.87-1.85 Ga)
Granitic plutons (2.0-1.9 Ga)
Trans-Hudson internides mostly (1.91-1.81 Ga)
2.1-1.8 Ga sedimentary rocks
Hurwitz, Amer groups (>1.95 Ga & 2.45-2.1 Ga)
2.5-2.4 Ga Sherman sedimentary rocks
Greenstone belt (mostly ~ 2.7 Ga)
Rae Craton 2.7-2.6 Ga granitic gneiss
CB Chesterfield Block 2.7-2.6 Ga granitic gneiss
Hearne Craton 2.7-2.6 Ga granitic gneiss
Slave Craton 4.04-2.58 Ga basement, meta-seds., meta-volcs., granitoids
Fault, shear zone or thrust
Gulf of Boothia
Baffin Island
Boothia Peninsula
Melville Peninsula
Queen Maud Gulf
TTZ
QMB
AG
Arrowsmith
Rae
Slave
Nunavut
NWT
Thelon Basin
Southampton Island
Kx
CBx
DBx
Baker
Gt. Slave L.
TMZ
NG
Arrowsmith
Rae
CB
STZ
Ux
Hudson Bay
NWT
Saskatchewan
Athabasca
Alberta
STZ
Hearne
Nunavut
Manitoba
Athabasca Basin
EoS
200 km

Figure 1: Geological map of mainland Rae craton modified from figures by Berman et al. (2005) and Corrigan et al. (2013); base geology for the figure provided courtesy of Rob Berman, 2017. Modifications based on information in Davis et al. (2003), Tella et al. (2007), Pehrsson et al. (2014a,b) and Skulski et al. (2018). AG, Amer Group; CB, Chesterfield block; CBB, Committee Bay belt; CBx, Cross Bay complex; DBx, Daly Bay complex; Kx, Kramanituar complex; NG, Nonacho Group; QMB, Queen Maud block; STZ, Snowbird tectonic zone; TMZ, Talston magmatic zone; TTZ, Thelon tectonic zone; Ux, Uvauk complex. Arrowsmith orogen lies northwest of heavy dashed blue line, position based on Berman et al. (2013).

On the Canadian mainland, the focus of this study, the craton is flanked to the northwest and southeast, respectively, by the Archean Slave and Hearne cratons. It has a minimum width of about 300 km near the aforementioned lakes and attains a width of almost 900 km where it extends along the Boothia Peninsula. The Archean Chesterfield block, separating the Rae and Hearne cratons in the area of Baker Lake, is believed to have accreted to the Rae craton in the latest NeoArchean (Pehrsson et al., 2013), and is now considered part of the Rae craton (Pehrsson, personal communication, 2017). Lakes and other geographical features referred to in the text are displayed on Figure 2.

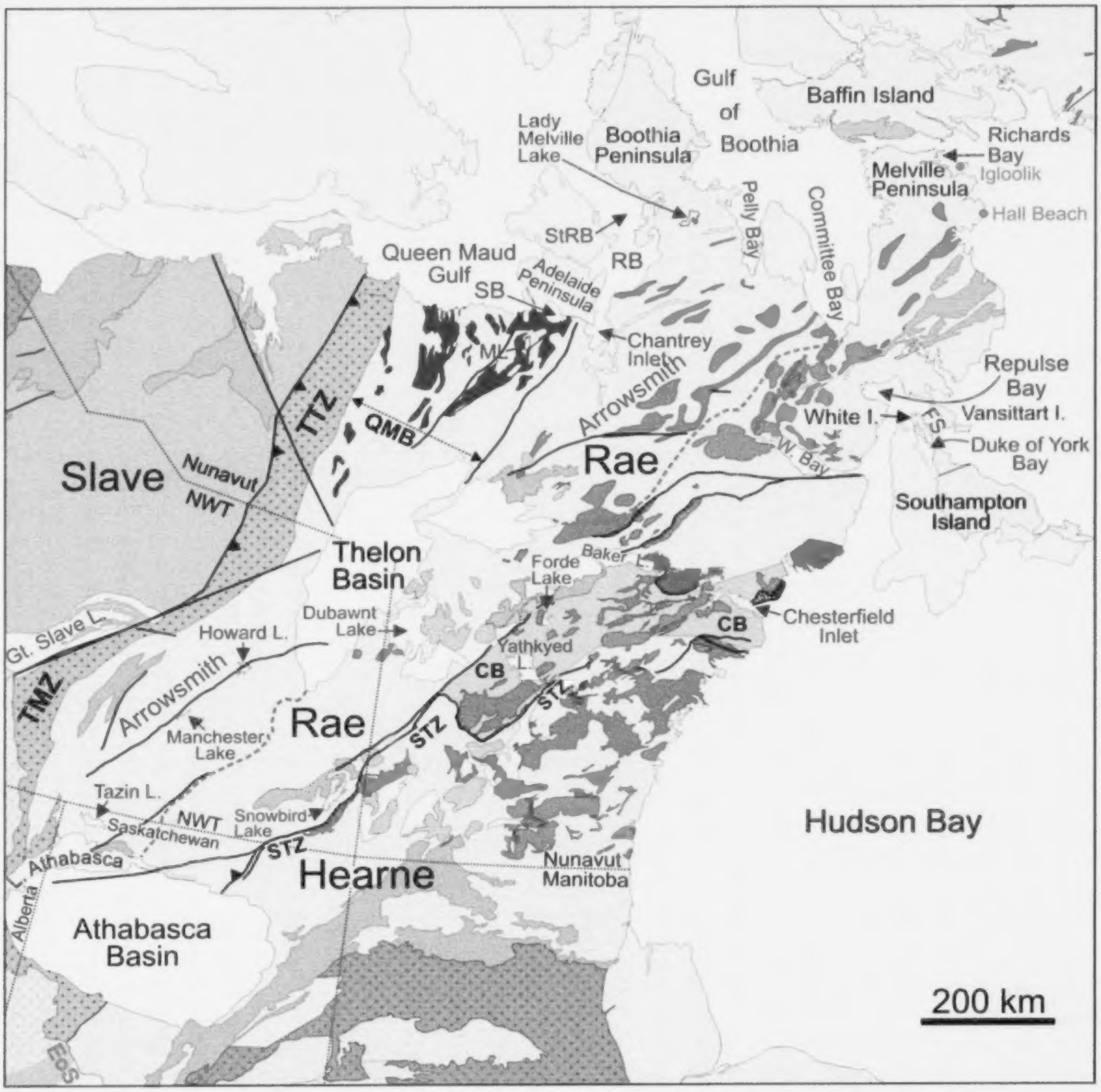
Gulf of Boothia
Baffin Island
Lady Melville Lake
Boothia Peninsula
Richards Bay
Igloolik
Melville Peninsula
Hall Beach
Pelly Bay
Committee Bay
StRB
RB
Queen Maud Gulf
SB
Adelaide Peninsula
ML
Chantrey Inlet
Arrowsmith
Repulse Bay
Vansittart I.
White I.
FS
W. Bay
Duke of York Bay
TTZ
QMB
Rae
Slave
Nunavut
NWT
Southampton Island
Thelon Basin
Forde Lake
Baker L.
Chesterfield Inlet
CB
Gt. Slave L.
Howard L.
Dubawnt Lake
Yathkyed L.
CB
TMZ
Arrowsmith
Rae
STZ
Manchester Lake
Tazin L.
NWT
Saskatchewan
Snowbird Lake
STZ
L. Athabasca
Alberta
Hearne
Nunavut
Manitoba
Hudson Bay
Athabasca Basin
200 km
EoS

Figure 2: Geological map of mainland Rae craton (Fig. 1) with lakes and other geographical features cited in the text. CB, Chesterfield block; QMB, Queen Maud block; STZ, Snowbird tectonic zone; TMZ, Talston magmatic zone; TTZ, Thelon tectonic zone; Arrowsmith orogen lies northwest of heavy dashed dark grey line, position based on Berman et al. (2013). FS, Frozen Strait; ML, McNaughton Lake; SB, Sherman Basin; StRB, St. Roch Basin; RB, Rasmussen Basin; W. Bay, Wager Bay.

According to Berman et al. (2013) the Rae craton consists of Meso- to NeoArchaean tonalitic to granitic orthogneisses, which in the northeastern portion of the craton host northeast-trending komatiite-bearing greenstone belts (Fig. 1). These belts are intruded by 2.72–2.64 Ga tonalite and approximately 2.62–2.58 Ga voluminous, dominantly monzogranitic plutons distributed throughout most of the Rae craton. Structural and metamorphic reworking of the Rae craton was effected by several orogenies: the 2.56–2.50 Ga MacQuoid orogeny, the 2.5–2.3 Ga Arrowsmith orogeny, the 2.0–1.91 Ga Taltson and Thelon orogenies, and the 1.9–1.8 Ga Hudsonian orogeny (Berman et al., 2013). The Arrowsmith orogeny produced the Arrowsmith orogen which runs along the northwestern margin of the Rae craton forming more than half of the craton (Fig.1). The large sedimentary Late Proterozoic Thelon basin trends broadly south-southwest to north-northeast across the central portion of the Rae craton, and the sedimentary Palaeoproterozoic Athabasca basin borders the southwestern extremity of the craton.

Although many areas of the Rae craton have been mapped at various scales over the years, Pehrsson et al. (2013) note that the western Churchill province, of which the Rae craton forms a major portion, is more poorly known than some other cratons consequent on lack of infrastructure access. The structural province is, however, extensively covered by aeromagnetic surveys carried out as part of Canada's National Aeromagnetic Mapping Program, and by several other higher resolution surveys completed in support of specific Geological Survey of Canada programs, such as GEM (Geo-mapping for Energy and Minerals) and TGI (Targeted Geoscience Initiative). These aeromagnetic data have made significant contributions to the enhancement and understanding of geology, and assessment of mineral potential within the craton, for example Berman et al. (2015a), Harris et al. (2015) and Tschirhart et al. (2014). These demonstrations of the utility of magnetic data have prompted the present study to examine magnetic signatures over the entire mainland portion of the Rae craton and their geological significance. The expectancy is that the magnetic perspective will reveal previously unrecognized aspects of the geology, and also raise important questions for which the search for answers should lead to improved understanding of geological relationships, structures and crustal evolution.

Geological Setting

As noted, the Rae craton has a protracted history of events, including intrusion and structural and metamorphic reworking effected by several orogenic episodes spanning a period from about 2.72 Ga to 1.80 Ga (Berman et al., 2013). It is formed dominantly of tonalitic to granitic orthogneisses, but this gneissic terrain is punctuated by belts of sedimentary rocks and greenstone located mainly north and northeast of the Thelon basin (Fig. 1). Greenstone belts, trending generally northeast to east-northeast, are concentrated east of the Chantrey fault zone (Fig. 3) within the southern part of the Boothia Peninsula and adjacent mainland, one of which is the Committee Bay belt (Fig. 1) (Berman, 2010; Skulski et al., 2018). West of the fault zone, within the Queen Maud block (Fig. 1), roughly north- to northeast-trending belts of the metasedimentary Sherman Group (Schultz et al., 2007; Skulski et al., 2018) are conspicuous. Several other mainly sedimentary belts trending generally north-northeast to northeast are scattered in other parts of the Rae craton (Fig. 1). Examples are a large belt south of the East Arm of Great Slave Lake containing rocks of the Nonacho Group (Pehrsson et al., 2014a,b), and a belt containing Amer Group rocks located at the northeast margin of the Thelon basin (Fig. 1) (Skulski et al., 2018). The Palaeoproterozoic Thelon basin contains the youngest Precambrian sedimentary rocks in the Rae craton and is a prominent feature in the centre of the craton.

The greater portion of the Rae craton has geological map coverage provided by 3 maps, each at 1: 550 000 scale, representing compilations of vintage and more recent mapping at scales ranging from 1: 25 000 to 1: 1 000 000 (Tella et al., 2007; Pehrsson et al., 2014a,b; Skulski et al.,

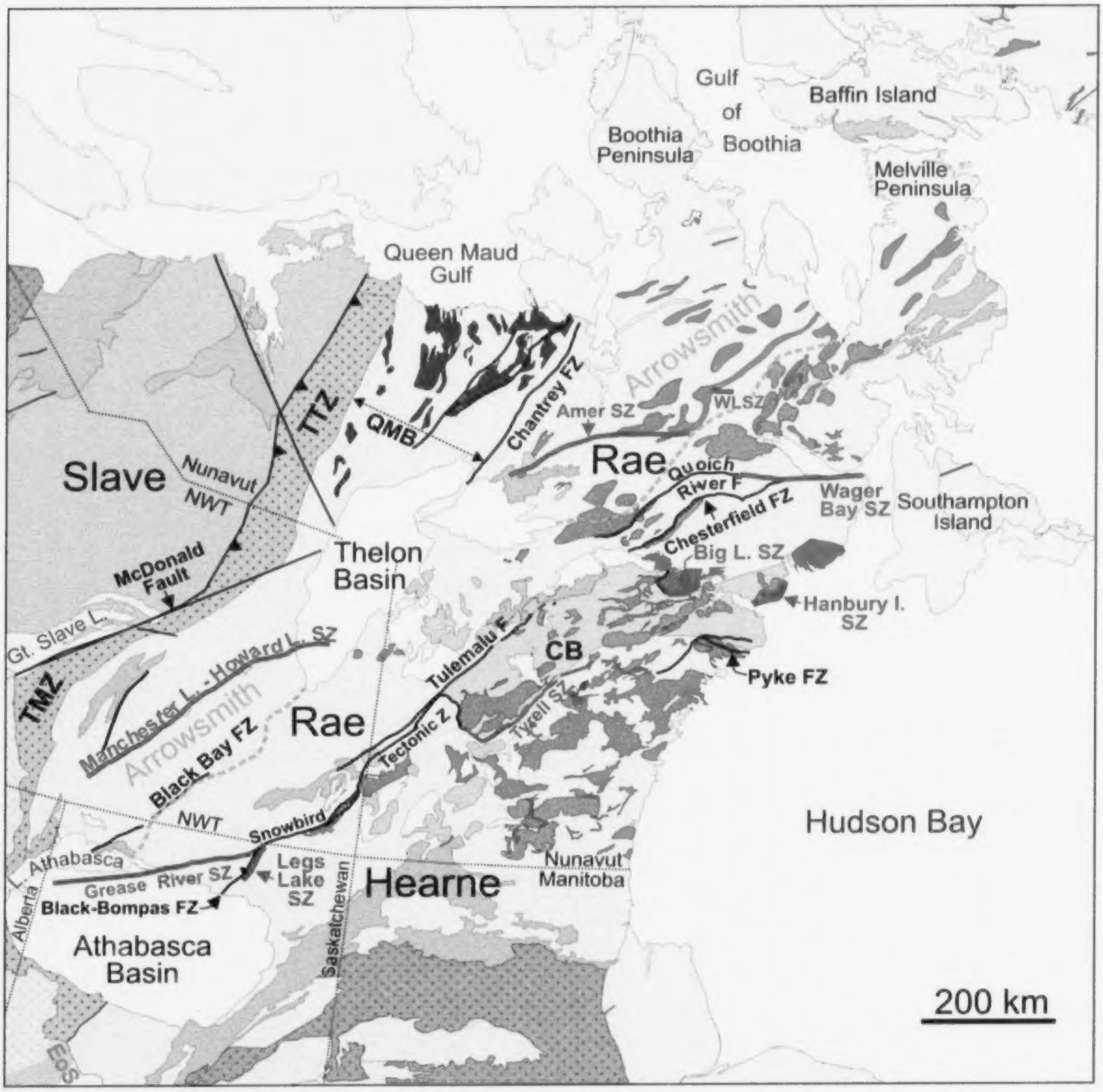
Gulf
of
Boothia
Baffin Island
Boothia
Peninsula
Melville
Peninsula
Queen Maud
Gulf
Arrowsmith
Chantrey FZ
QMB
TTZ
Amer SZ
WLSZ
Rae
Quoich
River F
Chesterfield FZ
Wager
Bay SZ
Southampton
Island
Slave
Nunavut
NWT
McDonald
Fault
Thelon
Basin
Big L. SZ
Hanbury I.
SZ
Gt. Slave L.
Manchester L.-Howard L. SZ
TMZ
Arrowsmith
Rae
Black Bay FZ
Tulemalu F
CB
Pyke FZ
Tectonic Z
Tyrell SZ
NWT
Snowbird
Hudson Bay
L. Athabasca
Legs
Lake
SZ
Nunavut
Manitoba
Hearne
Grease River SZ
Black-Bompas FZ
Alberta
Saskatchewan
Athabasca
Basin
200 km
EoS

Figure 3: Geological map of mainland Rae craton (Fig. 1) with labelled faults (F), fault zones (FZ), shear zones (SZ) and zones (Z) cited in text. CB, Chesterfield block; QMB, Queen Maud block; TMZ, Talston magmatic zone; TTZ, Thelon tectonic zone; WLSZ, Walker Lake shear zone; Arrowsmith orogen lies northwest of heavy dashed orange line, position based on Berman et al. (2013).

2018). Given the large size of the study area and concomitant scale of investigation of magnetic signatures, the 1: 550 000 scale of the geology is satisfactory for the objectives of the study. An area lacking relatively detailed geological mapping is a significant portion of the western part of the Queen Maud block and some adjacent portions of the Thelon tectonic zone. This area is entirely covered by a geological map of the Arctic (Harrison et al., 2011) and of Nunavut (de Kemp et al., 2006), but at the very large scales of 1: 5 000 000 and 1: 3 500 000, respectively. A geological map of a portion of the area is displayed in figures presented in a report by Berman et al. (2015b). A predictive geological map covering most of this area has been derived by Harris et al. (2015) based on magnetic, gamma ray spectrometer and LANDSAT data. For initial, direct comparison of magnetic signatures with geology, however, this was not used, because of the significant contribution made to this map by magnetic data. The increased use of magnetic data by mapping geologists means that comparison of magnetic maps with geology maps may result in correlation of a magnetic signature with a geological feature based largely on magnetic interpretation. Calibration of magnetic anomalies with specific geology may therefore be less reliable where consideration of magnetic signatures has played a significant role in producing a geological map. An index of the geological coverage of the study area afforded by the aforementioned maps and figures and by some other maps is shown in Figure 4. The distribution of map images produced by Harris et al. (2015) is not included.

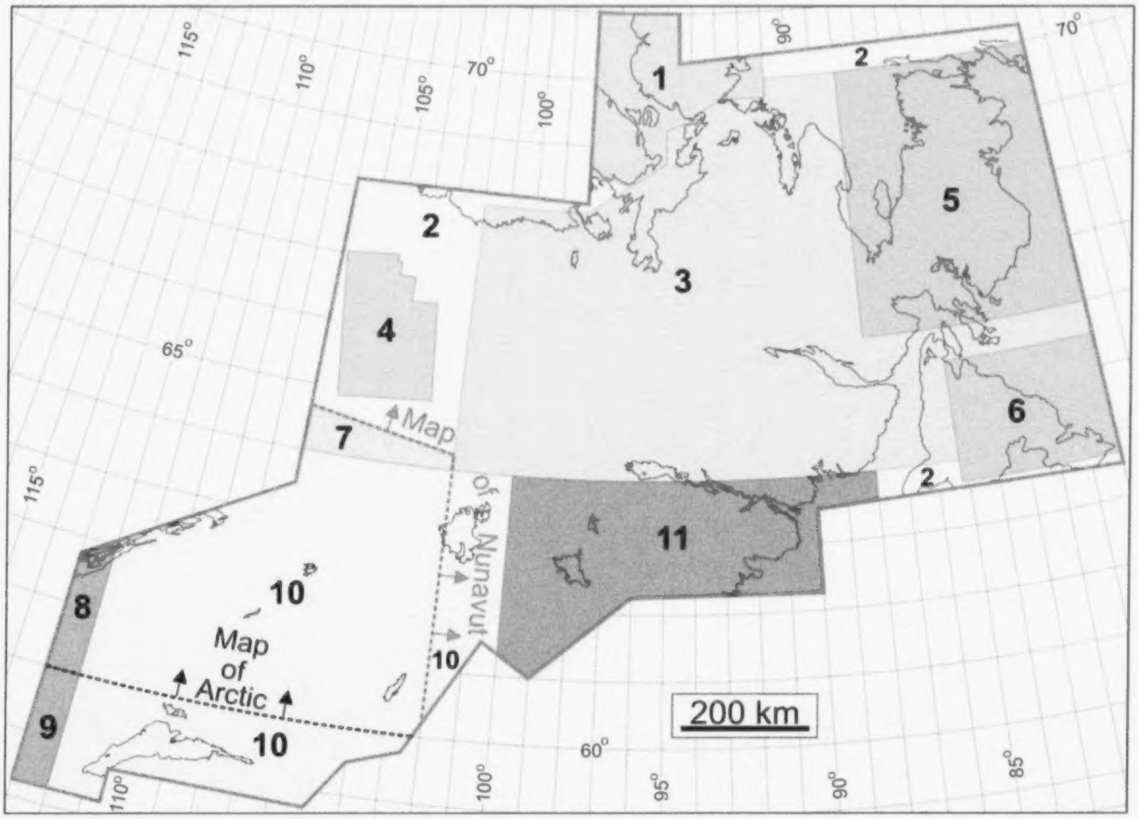

Figure 4: Index map of geological maps and map figures used for correlations with magnetic anomalies: (1) Harrison et al. (2015), (2) de Kemp et al. (2006), (3) Skulski et al. (2018), (4) Berman et al. (2015b), (5) Corrigan et al. (2013), (6) Sanborne-Barrie et al. (2014b), (7) Harrison et al. (2011), (8) Irwin (2014), (9) Prior et al. (2013), (10) Pehrsson et al. (2014a), (11) Tella et al. (2007). The map of the Arctic (reference 7) covers all of the study area north of latitude 60^{O}; it is shown in green in area 7, where coverage is also provided by a map of the Northwest Territories linked to reference 8. The map of Nunavut (reference 2) covers all of the study area north and east of the heavy dashed red line.

The overall trend of the Rae craton is southwest to northeast, but internally a strong linear structural grain with the same orientation is not widely developed. One notable exception is present on the southern part of the Boothia Peninsula and adjacent mainland north of Wager Bay, where variably alternating belts of Proterozoic granites and supracrustal rocks and belts of Archean granite, granodiorite, tonalite, gabbro-diorite, paragneiss and supracrustal rocks parallel the general trend of the craton (Skulski et al., 2018). Another is the southwestern portion of the Chesterfield block where several belt-like units of Palaeoproterozoic lamprophyre lavas, breccias, subaerial and subaqueous deposits, NeoArchean and/or Palaeoproterozoic mafic-intermediate volcanic rocks, and NeoArchean tonalite, granite, metasedimentary rocks and mafic/intermediate volcanic rocks are variably juxtaposed and strike northeast (Tella et al., 2007). Elsewhere there are sporadic occurrences of linear belts. One of the better examples trending northeast in harmony with the Rae craton is the metasedimentary belt immediately northeast of the Thelon basin formed mainly of rocks of the Amer Group (Jefferson et al., 2015). A second noteworthy example is a belt of linear units sitting astride, and running parallel to, the Manchester Lake-Howard Lake shear zone (Fig. 3) immediately west of the south end of the Thelon basin. NeoArchean and/or Palaeoproterozoic units include a felsic to intermediate gneiss complex, a unit of tectonite-mylonite-straight gneiss-strongly foliated gneiss, a unit of metasedimentary rocks and a unit of foliated to mylonitic granite to granodiorite; there is also an Archean unit of granodiorite to tonalite (Pehrsson et al., 2014a,b). The Palaeoproterozoic Nonacho Group of sedimentary rocks forms a noticeable belt near the western margin of the Rae craton (Fig. 1), but trends approximately north-northeast, sub-parallel to the nearby Talston magmatic belt to the west, at a high angle to the general trend of the craton.

Apart from these linear belts and smaller scattered linear to curvilinear belts, the Rae craton is dominated by generally broad areas of NeoArchean and/or Proterozoic, Archean to Proterozoic, NeoArchean and Archean (undivided) gneissic and/or plutonic rocks with compositions of the latter including granite, granodiorite, quartz monzonite, monzogranite and mafic-rich granodiorite to tonalite (Pehrsson 2014a,b; Skulski et al., 2018). These areas are typically somewhat irregular in shape, though some are belt-like, such as a Palaeoproterozic granite and unit of NeoArchean mixed gneisses northeast of Baker Lake, a similar gneiss unit flanking the northwestern side of the Chantrey fault zone (Fig. 3) and a NeoArchean unit of granodiorite flanking the southeastern side (Skulski et al., 2018). Some Archean-Proterozoic gneissic and plutonic units, Meso-NeoArchean gneiss units and the Palaeoproterozoic sedimentary Sherman Group within the Queen Maud block also display a belt-like nature (Skulski et al., 2018).

Major Faults

Faults often bound major crustal blocks or terranes, so it is important to recognize their presence in defining magnetic domains. Faults, fault zones and shear zones specifically mentioned in this report are outlined in Figure 3. Several extensive major faults and numerous smaller faults are distributed throughout the Rae craton and at its margins. West of the Thelon basin the northwestern margin is bounded by the northeast-trending McDonald fault, a brittle fault zone aligned with the dextral mylonitic Great Slave Lake shear zone (Hoffman, 1987). The southeastern margin of the craton is marked by the northeast-trending Snowbird tectonic zone (Fig. 3), the southwest section of which is displayed on the map by Pehrsson et al. (2014a,b). The geometry of this section, shaped in part by three mafic to intermediate "lozenges" of middle Archean crust (Hanmer et al., 1994), is attributed principally to interaction between crosscutting Palaeoproterozoic intracontinental thrust and strike-slip shear zones (Mahan and Williams, 2005). The Snowbird tectonic zone is now believed to swing abruptly into a southeastward direction near the boundary between the maps of Pehrsson et al. (2014a,b) and Tella et al. (2007) (Pehrsson, personal communication, 2017), continuing for about 100 km before swinging abruptly northeastward to link with the Tyrell shear zone (Fig. 3). On their map, Tella et al. (2007) identified the Snowbird tectonic zone as a fault along strike from a fault adjacent and sub-parallel to the fault currently identified as the tectonic zone by Pehrsson (Personal communication, 2017). The southwestern portion of this fault coincides with the Tulemalu fault (Fig. 3) of Eade (1985). Figures, though lacking some detail, and text in papers by Sanborn-Barrie et al. (2001), Mahan and Williams (2005) and Berman et al. (2007) indicate that earlier concepts of the Snowbird tectonic zone envisioned it as continuing northeast through Baker Lake, swinging eastward to skirt the northern margin of the Kramanituar complex (Fig. 1) and terminating at the coast of Hudson Bay. The Tyrell shear zone apparently links with the Pyke fault zone near Hudson Bay (Fig. 3) (Tella et al., 2007; Berman et al., 2007).

In the interior of the Rae craton two conspicuous faults southwest of the Thelon basin (Fig. 3) are the Black Bay fault striking northeast from Lake Athabasca, and the significantly more extensive, parallel Manchester Lake – Howard Lake shear zone that cuts both the Thelon basin and pre-basin basement rocks (Pehrsson et al., 2014a,b). Recent studies of the Black Bay fault (Jamison et al., 2015) indicate shear motion along the fault has been predominantly dextral with evidence for earlier sinistral motion, and that differential uplift has occurred along the fault. The Manchester Lake – Howard Lake shear zone is described as a zone of ductile high strain greater than 500 km long and 10 km wide extending from Manchester Lake to the Thelon basin (Pehrsson et al., 2005). South of Great Slave Lake a prominent, approximately 140 km long, north- to north-northeast-trending fault runs close to the eastern margin of a belt of Nonacho Group sedimentary rocks (Figs. 1, 3) (Pehrsson et al., 2014a,b).

Northeast and east of the Thelon basin the most prominent faults are the Chantrey and Chesterfield fault zones, the Quoich River fault, and the Amer and Wager Bay shear zones (Fig. 3). The Chantrey fault zone runs northeast for about 300 km from the north end of the Thelon basin before terminating at a unit of Ordovician-Silurian limestone near the coast (Skulski et al., 2018). The fault zone was linked with what is now known as the Great Slave Lake shear zone (Hoffman, 1987) by Heywood and Schau (1978) who referred to this composite structure as the Slave-Chantrey mylonite zone, and identified it as the eastern boundary of the Queen Maud block (Fig. 3). Noting that mainly granulite grade rocks of the Queen Maud block are juxtaposed along less deeply eroded parts of the Rae craton along oblique east-vergent reverse faults, Hoffman (1989) implied the Chantrey fault zone was such a fault. Tella (1994) mapping at the south end of the fault zone found evidence for latest movement along the fault to be low-angle oblique slip with an apparent dextral sense of shear.

The Amer shear zone, labelled mylonite zone on the map of Skulski et al. (2018) and noted to be a dextral, oblique-slip fault zone (Sanborn-Barrie et al., 2014a), extends for about 265 km across mainly gneissic terrain from the vicinity of the northeastern margin of the Thelon basin (Fig. 3). It trends initially roughly east-northeast before swinging gradually eastward. Noticeably, it bounds a large unit of granulitic rocks along a section of its eastern extent (Skulski et al., 2018). Within the study area, the Wager Bay shear zone trends westward from the eastern shore of Wager Bay for about 145 km to link with the roughly 250 km long Quoich River thrust (Skulski et al., 2018) that extends the westward trend before swinging southwest and terminating just north of Baker Lake (Fig. 3). Henderson and Broome (1990) describe the Wager Bay shear zone as a transcurrent, ductile shear zone within which structural fabric elements consistently confirm dextral shear sense. The Chesterfield fault zone is sub-parallel to the Quoich River thrust, extending for about 300 km and lying variably some 30 km to 50 km to the south (Skulski et al., 2018), but converges on the western part of the Wager Bay shear zone near its eastern extremity (Fig. 3). A short southwestern section is displayed as a southeast-dipping thrust (Skulski et al., 2018), and Berman et al. (2007) identified the Chesterfield fault zone as a northwest-vergent thrust.

In describing relationships between magnetic signatures and geological units in the section describing magnetic domains the list of rock-types in a unit as presented in the legends for the various geological maps may be extensive, so in some cases only the principal rock-types are mentioned. To facilitate a requirement for more detail the legend abbreviation, if available, accompanies the mentioned units/rock-types in the descriptions.

Magnetic Data

The magnetic data for this study were obtained from Natural Resources Canada's Geoscience Data Repository (http://gdr.agg.nrcan.gc.ca/gdrdap/dap/search-eng.php) and represent principally data collected for the Canadian National Aeromagnetic Mapping Program. These data were generally collected in airborne surveys flown at a line-spacing of 805 m and mean terrain clearance (MTC) of 305 m. Exceptions are two surveys on the Boothia Peninsula and a small survey near the southwestern margin of the area having a line-spacing of 400 m and MTC of 150 m. The data are used to produce grids having a cell size of 200 m, maps developed from which have adequate resolution for purposes of regional studies such as the present study. Use of these "national" data ensures uniformity in details of magnetic signatures across the entire region. Many areas are covered by higher resolution magnetic data producing grids typically having a cell size of 100 m. Such data can be interrogated in the pursuit of more detailed studies within such areas.

A shortcoming of some of the magnetic data compiled into the national 200 m grid is related to deficiencies in levelling of the survey data. This often results in discrepancies in the background levels of the magnetic field along adjacent flight-lines that produce a linear grain within the magnetic field. The prominence of such a grain will vary according to the size of the discrepancies. Sometimes the linearity in the magnetic field is subdued, but nevertheless poses a visual problem for an interpreter more interested in focussing on signatures related to geology. Such linear artifacts are particularly problematic in attempting to identify and delineate faults or dykes from the magnetic data that may be oriented parallel or sub-parallel to flight-lines. Faults are often expressed as linear magnetic lows consequent on ground water alteration of magnetite to more weakly magnetic hematite. Dykes, often mafic in nature, generally produce linear positive anomalies, though degeneration of magnetite or a reversed component of magnetization can result in dykes being associated with negative magnetic anomalies. A less serious deficiency of the national magnetic grid is the fact that data in early surveys were not acquired digitally and they were presented in the form of contoured maps. These maps were later digitized by picking values at intersections of flight-lines and contours, which effectively means that the resolution of the data was somewhat degenerated vis-à-vis data collected digitally in a similar survey.

Presentation of Magnetic Data

Four types of magnetic map were used for defining domains: residual total magnetic field (RTMF), first vertical derivative (FVD) of the residual total magnetic field, tilt of the residual total magnetic field and peak values of the residual total magnetic field. The first three types of map were shaded to enhance various features by a process simulating the effects of light directed on the three-dimensional surface defined by the grid of magnetic anomaly values. Shading produces areas of varying brightness and areas of shadow, an effect very similar to that created by the sun shining over a range of hills. The light direction and its inclination from horizontal can be varied, providing different images in which certain features may be enhanced or suppressed.

Magnetic surveys measure the "total magnetic field" of the Earth representing essentially the combined magnetic expressions of the Earth's core and crust, with atmospheric electrical currents making a very minor contribution. Typically, the main objective of magnetic surveys is investigation of the crust, and thus the component related to the core is eliminated by removing a reference field such as the International Geomagnetic Reference Field. The resulting field is termed the residual total magnetic field (RTMF), related principally to magnetizations within the crust. It is characterized by both negative and positive values, instead of consistently positive absolute total field values.

The RTMF map portrays the strength of magnetization of the underlying rocks, with strong magnetizations producing large positive anomalies (magnetic highs). Weak magnetic rocks produce relatively negative anomalies (magnetic lows), though some lows, because of the dipolar nature of magnetization, may simply represent the low accompanying a high produced by a magnetic body. Commonly in Canada, where the Earth's magnetic field is inclined steeply northward, such lows are positioned approximately northwest to northeast of the complementary high. The RTMF response is, therefore, an important criterion for distinguishing areas associated with different magnetizations and, by proxy, possible different rock-types. Many RTMF highs are a composite signature defined by several different magnetic bodies having different magnetizations that are juxtaposed and/or in close proximity to one another. The presence of these individual bodies may be difficult to recognize in the RTMF signature, mainly because peak areas of highs are defined by a continuum of red shades that may inhibit clear discrimination of related component anomalies that may have different wavelengths. A solution to recognition of such anomalies is found in maps of derivatives of the RTMF. In this study the FVD and the tilt of the magnetic field.

The FVD, or vertical gradient, of the RTMF is a very common form of portraying magnetic data. Images of the FVD are undoubtedly the best known derived product of the RTMF. They have a certain advantage over RTMF images with respect to recognizing and defining smaller geological features, since vertical derivative anomalies produced by near-surface geological features are emphasized relative to those associated with deeper features, as the latters' longer wavelength anomalies tend to be removed. A related benefit is that signatures of closely spaced geological units are better resolved, since vertical derivative anomalies are narrower than counterparts in the RTMF, and also vertical contacts are delineated directly by the zero contour at high magnetic latitudes (Hood and Teskey, 1989).

Magnetic tilt was a concept developed by Miller and Singh (1994) to detect sources of potential field anomalies using vertical and horizontal derivatives. Tilt angle is the parameter derived from the ratio of the FVD to the absolute horizontal derivative, or as Miller and Singh (1994) express it:

$$\text{TILT} = \tan^{-1}(\text{vertical component of gradient/horizontal component of gradient})$$

Those authors note that by expressing the parameter as a tilt angle rather than a ratio it will always be in the range $-90° < \text{TILT} < 90°$. It will be relatively insensitive to the depth of the source and should resolve shallow and deep sources equally well. Furthermore, it is positive over a source, falling to zero at, or near, the edge of a vertical-sided source, and is negative outside the source.

The FVD and tilt maps both provide great detail of the magnetic fabric and texture. They commonly display belts of closely spaced linear to curvilinear anomalies of varying extent. Less extensive oval and more irregularly shaped anomalies, some isolated, some distributed irregularly in groups, and some arranged with some degree of linearity pervade the entire area. Very extensive, narrow linear magnetic highs define the paths of dykes. Collectively the anomalies in the FVD and tilt maps reflect very well the patterns of structural fabric in the area.

Because peak areas of magnetic highs in RTMF maps are commonly defined by a continuum of red shades it can be difficult to compare the relative intensities of different highs. A map of peak values of the RTMF helps circumvent this problem. Colour coding circles marking peak positions facilitates recognition of groups of anomalies characterized by a particular general level of peak values, in turn helping delineation of magnetic domains.

The selection of contouring method, for example histogram equalization or linear, and the range of values in a data set can greatly affect the portrayal of magnetic data in a colour image. In the present case a common colour scheme using the rainbow spectrum of colours is used for RTMF images and a modified version in which cooler colours predominate is preferred for maps of the FVD and tilt. The tilt map, apparently, yields a higher resolution of magnetic features, compared to the FVD map that apparently portrays a smoother representation of the features. Nevertheless, both were engaged in defining magnetic domains and also in interpreting faults.

Maps of the residual total magnetic field, first vertical derivative of the magnetic field and tilt angle of the residual total magnetic field at a scale of 1: 2 400 000, with marginal notes, are presented in an accompanying publication by Thomas (in press). All of these maps display the magnetic domains defined and described herein. Additionally, a map of the residual total magnetic field also displays mapped geological contacts, and another displays faults interpreted from the magnetic maps.

In the interest of brevity of descriptions the terms "linear" or "curvilinear" are often used in the role of a noun to refer to narrow linear magnetic anomalies that are relatively straight or slightly curved, respectively. Accompaniment by the adjective "discontinuous" describes more than two collinear or approximately collinear distinct linear magnetic anomalies, or even short oval to circular anomalies that are separated by a weak linear expression or a neutral magnetic field, possibly related to longitudinal variations in susceptibility or dissection by a fault.

Another term used to describe patterns of magnetic anomalies is "karst-like", by analogy with karst topography, which is developed typically through preferential erosion by acidic water of carbonate bedrock surfaces along joints or bedding planes, producing a landscape dissected by linear chasms. Patterns vary according to the concentration and orientations of such discontinuities. These karst-like patterns in the RTMF image appear as a "roughness" on the surface of the magnetic field.

Definition of Faults

Many faults are defined by narrow, linear and curvilinear magnetic lows related to enhanced ground water alteration of magnetite to more weakly magnetic hematite along the path of disturbed rock. Faults may also be recognized by offsets of anomalies, aligned distinct linear edges of a group of anomalies or a linear edge of a single large anomaly. Such features may be present in residual total magnetic field maps and in maps of magnetic derivatives. The seemingly higher resolution tilt map displays hundreds, or possibly thousands, of linear/curvilinear lows, whose length varies from extremely short to extensive. Are all of these expressions of faults? It seems unlikely, with many simply being "apparent" lows between magnetic highs. Faults interpreted in this report are those associated with the more pronounced lows, so the interpretation does not necessarily represent an exhaustive display of all possible faults. A consideration in the interpretation of lows that run parallel with highs is the determination of whether the low is such an "apparent" low, a low associated with a relatively weakly magnetic geological unit or indeed a low caused by degradation of magnetite in a fault zone. There are probably many instances where such uncertainty has resulted in faults not being placed along distinct lows. In other cases "over-interpretation" may have resulted in a fault being positioned where no fault exists. The scale of the study limits interpretation of faults to definition of the most extensive and/or most obvious faults. Some distinct linear lows paralleling the flight line direction have deliberately not been identified as possible expressions of a fault for reason of poor levelling of magnetic data as previously discussed. A map of interpreted faults is presented in Figure 5.

Definition of Magnetic Domains

A total of 75 magnetic domains are defined covering the Rae craton and marginal areas. Their boundaries are superposed on the RTMF image in Figure 6. Four larger scale images of both the RTMF and tilt, with boundaries, providing coverage of the southwestern, southeastern, northeastern and northwestern portions of the Rae craton are provided in Figures 7 through 14 to complement descriptions of individual domains; an index of these areas is included in Figure 6. The relationship of the domains to magnetic features can also be examined in the map sheets at 1: 2 400 000 scale produced by Thomas (in press).

Geological input into definition of magnetic domains was minimal, the intent being creation of domains independent of any geological input. The objective is to define areas having distinctive magnetic signatures that could reflect crustal units having a particular lithological composition and/or structural fabric. In defining a magnetic domain consideration is given to the intensity, pattern and texture of anomalies, whether they are RTMF, FVD or tilt anomalies. A problem in defining domains is selection of the criteria that define a domain, and how to attribute weighting to the various criteria. In some cases the RTMF signature is so distinctive that a domain can be defined on the basis of the RTMF signature alone. For example, Domain 75 along the western margin of the Rae craton north of the McDonald fault could be defined solely on the basis of the most prominent RTMF anomaly within the Thelon tectonic zone (*see* Fig. 13). Patterns of FVD and tilt anomalies (*see* Fig. 14) and RTMF anomaly peak values corroborate definition of the domain. Domain 16 is defined principally by an area of positive RTMF (Fig. 7), but definition also requires input of the textural characteristics of the field, which are manifested with some prominence as superposed north-northwest-trending, irregularly linear, parallel to sub-parallel positive perturbations. These are emphasized in the FVD and tilt (Fig. 8) maps, where their north-northwest trend contrasts with the absence of a similar linear pattern to the north in Domains 14 and 15, where only a few linear anomalies, oriented northeast, are present. Most of Domain 15 is characterized by relatively distinct, short, oval-shaped and generally randomly distributed RTMF anomalies. Those in Domain 14 are much less distinct, being smoother and larger in area, possibly reflecting the buried nature of their source beneath the Thelon basin and resulting lack of resolution in definition of individual anomalies.

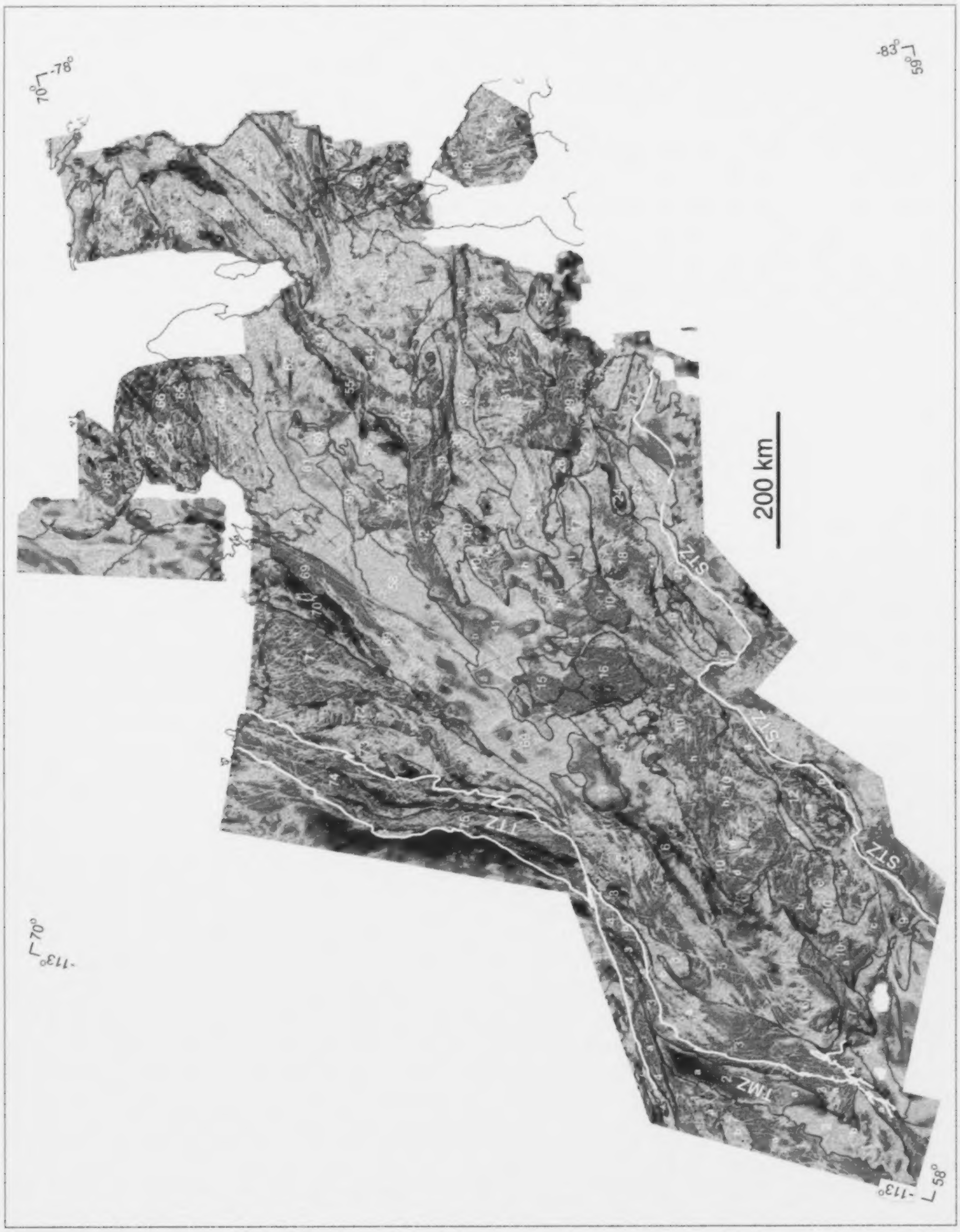
70° -78°
-83° 69°
200 km
STZ
STZ
STZ
TTZ
TMZ
70° -113°
-113° 58°

Figure 5: Map of residual total magnetic field of the Rae craton with boundaries of magnetic domains and subdomains and interpreted faults superposed. Domain numbers and subdomain letters are indicated. Heavy white lines define the Snowbird tectonic zone (STZ), Talston magmatic zone (TMZ) and Thelon tectonic zone (TTZ).

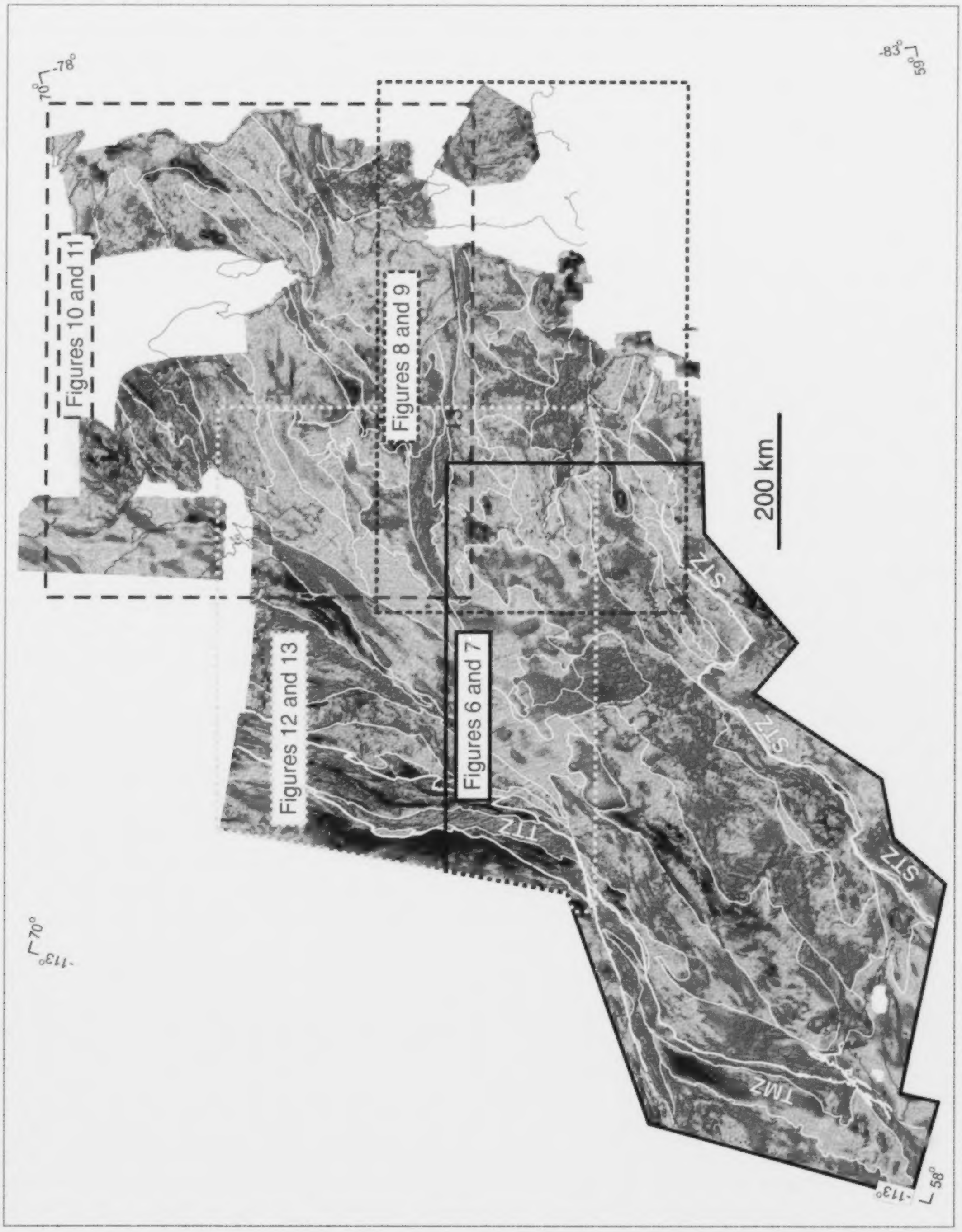
70°
-78°
-83°
59°
Figures 10 and 11
Figures 8 and 9
Figures 12 and 13
Figures 6 and 7
200 km
STZ
STZ
STZ
TTZ
TMZ
-113°
70°
-113°
58°

Figure 6: Index map for areas covered by magnetic images with superposed magnetic domains presented in Figures 6 through 13. Here, boundaries of the areas are superposed on a map of the residual total magnetic field. Heavy white lines define the Snowbird tectonic zone (STZ), Talston magmatic zone (TMZ) and Thelon tectonic zone (TTZ).

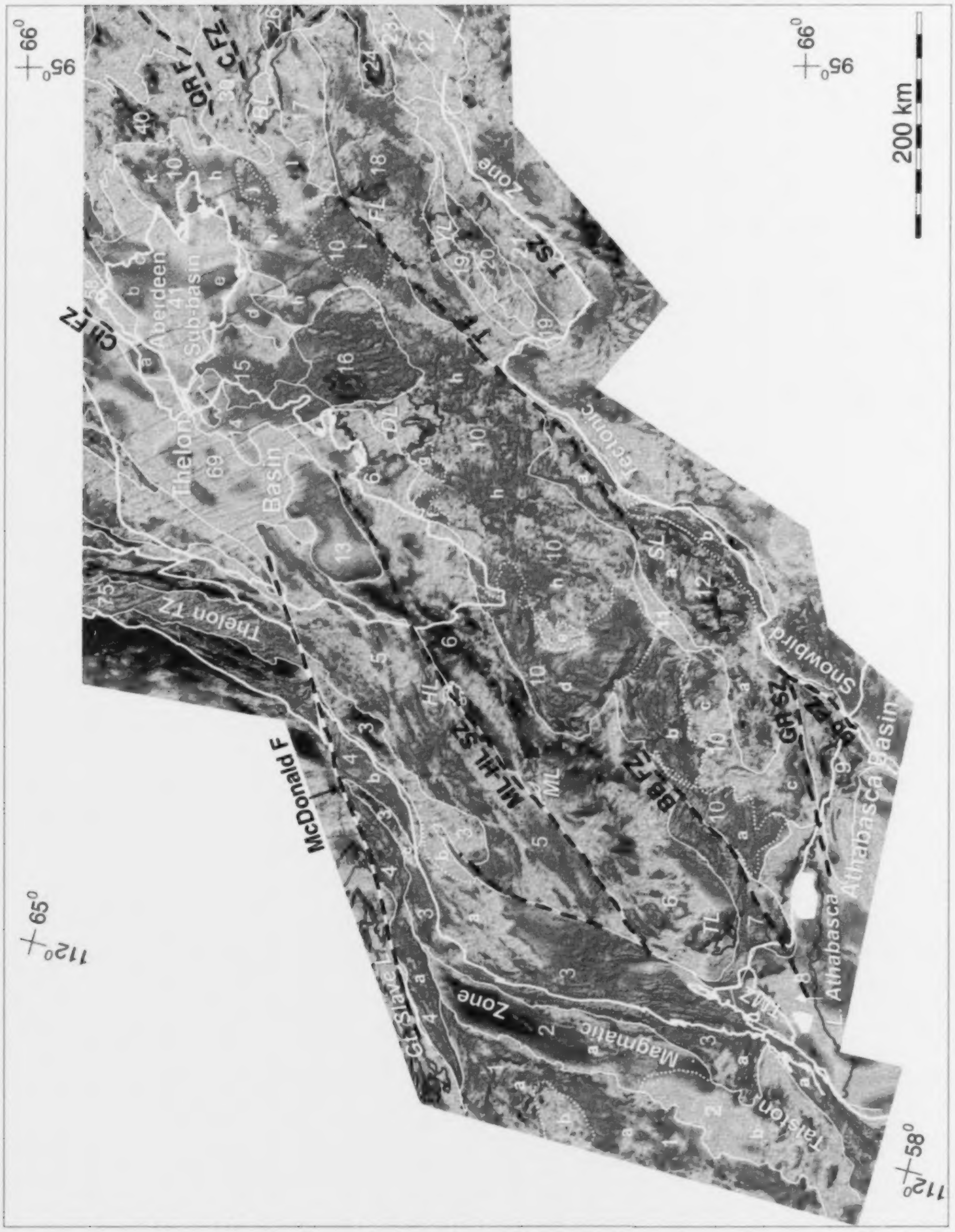
66°
95°
66°
95°
200 km
65°
112°
58°
112°
McDonald F
ML-HL SZ
BB FZ
GR SZ
bb FZ
Snowbird
Tectonic Zone
T SZ
T F
Ch FZ
QR F
C FZ
Aberdeen
Sub-basin
Thelon
Basin
Thelon TZ
Athabasca Basin
Athabasca
Taltson
Magmatic
Zone
TMZ
Gt Slave L
BL
FL
YL
DL
SL
HL
ML
TL

Figure 7: Map of residual total magnetic field for southwestern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: Thelon TZ = Thelon tectonic zone; TMZ, Thelon magmatic zone; bb FZ, Black-Bompas fault zone; BB FZ, Black Bay fault zone; C FZ, Chesterfield fault zone; Ch FZ, Chantrey fault zone; GR SZ, Grease River shear zone; ML-HL SZ, Manchester Lake – Howard Lake shear zone; QR F, Quoich River fault; T F, Tulemalu fault; T SZ, Tyrell shear zone (forms part of Snowbird tectonic zone). Lakes: BL, Baker Lake; DL, Dubawnt Lake; FL, Forde Lake; HL, Howard Lake; ML, Manchester Lake; SL, Snowbird Lake; TL, Tazin Lake; YL, Yathkyed Lake.

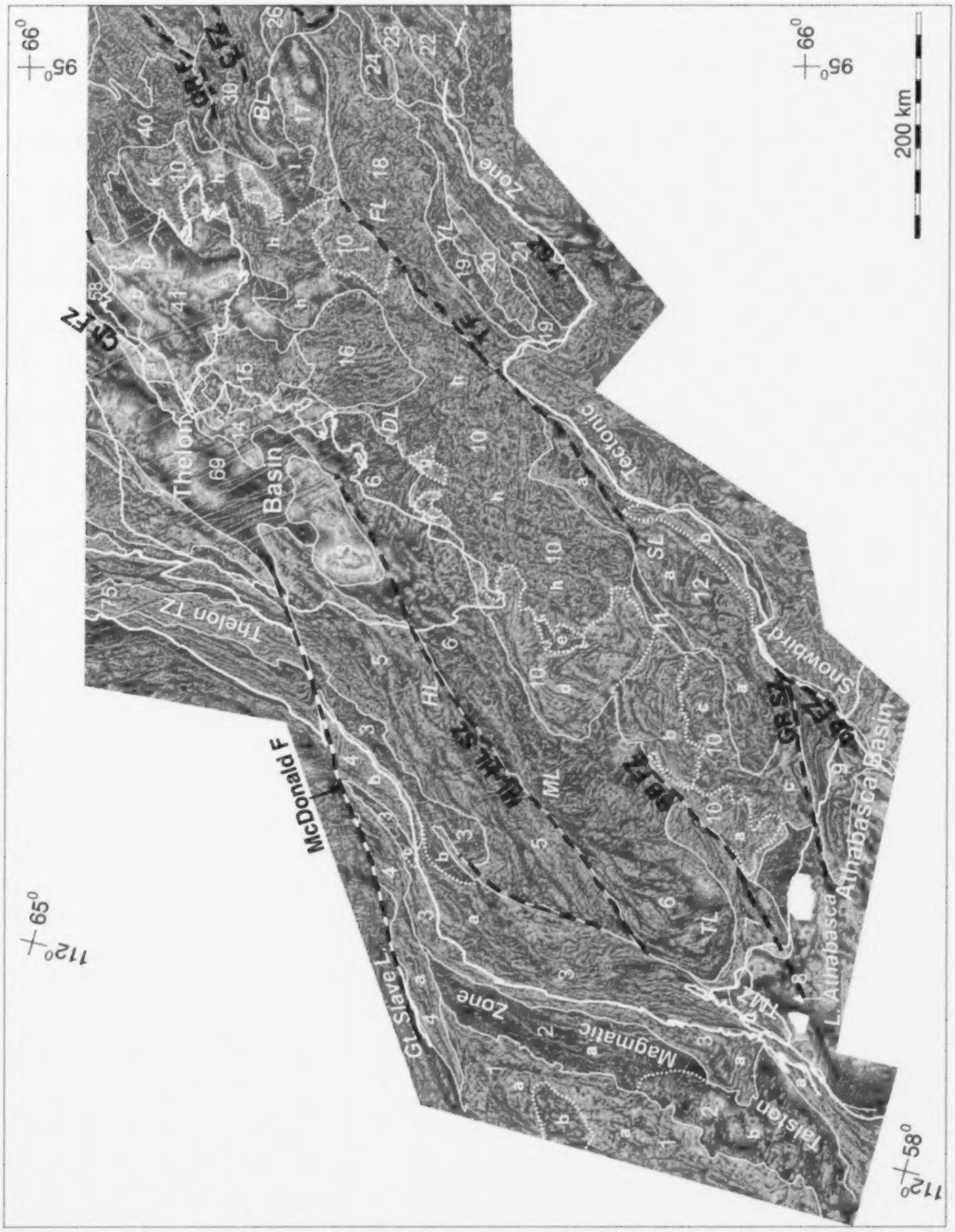
66°
95°
66°
95°
200 km
Thelon
Basin
Thelon TZ
McDonald F
Gt. Slave L.
Magmatic
Zone
Taltson
TMZ
L. Athabasca
Athabasca
Athabasca Basin
Snowbird
GR SZ
bb FZ
BB FZ
ML-HL SZ
T F
T SZ
QR F
C FZ
Ch FZ
Tectonic
Zone
BL
DL
FL
HL
ML
SL
TL
YL
65°
112°
58°
112°

Figure 8: Map of tilt of residual total magnetic field for southwestern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: Thelon TZ = Thelon tectonic zone; TMZ, Thelon magmatic zone; bb FZ, Black-Bompas fault zone; BB FZ, Black Bay fault zone; C FZ, Chesterfield fault zone; Ch FZ, Chantrey fault zone; GR SZ, Grease River shear zone; ML-HL SZ, Manchester Lake – Howard Lake shear zone; QR F, Quoich River fault; T F, Tulemalu fault; T SZ, Tyrell shear zone (forms part of Snowbird tectonic zone). Lakes: BL, Baker Lake; DL, Dubawnt Lake; FL, Forde Lake; HL, Howard Lake; ML, Manchester Lake; SL, Snowbird Lake; TL, Tazin Lake; YL, Yathkyed Lake.

Other domains display belts of both positive and negative RTMF anomalies and one could question why each individual high and low belt shouldn't be assigned domain status. However, examination of the FVD or tilt map reveals a parallel to sub-parallel linear fabric that extends across high and low RTMF belts defining a singular pattern that is used to define a magnetic domain. A good example is Domain 66 (*see* Figs. 11, 12) and to a lesser extent the portion of Domain 69 north of the Thelon basin (*see* Figs. 13, 14), though in the latter case the domain could probably be equally well defined on the basis of the RTMF anomaly characteristics or derivative anomaly characteristics alone.

The heterogeneity of alternating belts of positive and negative RTMF anomalies noted for Domain 66 is relatively simple, but heterogeneity can be much more complex. In dealing with heterogeneity one has the choice of defining many small domains corresponding to individual components of the heterogeneity mosaic, or using the heterogeneity as the "pattern" that defines a domain. The latter approach has been adopted in defining some of the large domains, certain heterogeneous patterns representing a signature that stands out from surrounding signatures. Good examples include the largest domain in the study area, Domain 10, and Domains 6 and 12 (Figs. 7, 8) and Domain 45 (*see* Figs. 11, 12). Given the small size of several other domains it may seem unreasonable to accept heterogeneity as a characteristic for domain definition. However, certain small domains were defined because of their position and "anomalous" nature with respect to adjacent domains. For example Domain 11 sitting between Domain 10 and Domain 12 (Figs. 7, 8) has RTMF and derivative patterns so different from those of the latter two domains that attention is drawn to it, and its definition as a domain seems warranted. Considering the size of the Rae craton it is felt that the somewhat inconsistent approach to domain definition is justified. The map of magnetic domains is a preliminary attempt to illustrate the overall heterogeneity of magnetic signatures present within the craton, and as studies proceed it is anticipated that the large magnetic domains will be subdivided into smaller magnetic units.

The 75 magnetic domains are compared with mapped geology presented mostly at the scale 1: 550 000 to determine the degree of correlation between magnetic anomalies and geological units in an effort to calibrate anomalies for further application of the magnetic method to support geological mapping in areas widely covered by glacial deposits. Descriptions of domains are linked to magnetic images in Figures 7 through 14. An image of the RTMF and of the tilt of the RTMF are presented for each of the four areas (Fig. 6) covered by the images, and these correspond, respectively, to the first and second figures listed along with each domain heading.

Magnetic Domains

Domain 1 (Figs. 7, 8): Domain 1 is the most westerly of three parallel north- to north-northeast-trending domains along the western margin of the Rae craton south of the McDonald fault. The geological coverage of the eastern margin of Domain 1 provided by the map of Pehrsson et al. (2014a,b) shows the boundary between the large Subdomain 1a and Subdomain 2a to the east following closely the contact between granite and pegmatite, referred to as Slave granites (PTsg), to the west, and granite, tonalite and quartz diorite to diorite of the Talston magmatic suite (PTg) to the east. Domain 1 is defined on the basis of its strong RTMF that contrasts with the prominent relatively negative RTMF signature of Domain 2. The magnetic derivative maps display a generally north- to north-northeast-trending discontinuous linear fabric within Subdomain 1a, though individual linear anomalies are somewhat more variable and broken near the McDonald fault, with some taking on a more northeastward orientation. A roughly oval area within the northern half of Subdomain 1a in which derivative highs are less concentrated and linear examples are not extensive, and small scattered oval-shaped anomalies are common, is defined as Subdomain 1b. The subdomain displays as a relatively negative signature in the RTMF map. A lack of detailed geological coverage west of 112^{O} W prohibits correlation of the subdomain with a particular Precambrian geological unit, besides which, much of the subdomain is underlain by Phanerozoic sedimentary rocks.

Domain 2 (Figs. 7, 8): Domain 2 is conspicuous by its prominent negative RTMF signature, particularly over its northern half where a partially developed linear fabric permits delineation of Subdomain 2a that contrasts with Subdomain 2b to the south, where the background RTMF is somewhat more elevated and small areas of magnetic high are developed. Some of the strongest and most extensive have an eastward to east-northeast orientation. Some very small (areally) highs are prominent, globular and generally scattered in various parts of Subdomain 2b.

Subdomain 2a coincides mainly with a north-south belt of granite, tonalite and quartz diorite to diorite of the Talston magmatic suite (PTg), though noticeably several units of Slave granites (granite and pegmatite) (PTsg) lie along the entire eastern margin of the subdomain and at its southern extremity. The limited coverage of Pehrsson et al.'s (2014a,b) map shows the northern tip of Subdomain 2b correlating with a unit of Slave granites (PTsg). Whether this extends further south awaits wider geological mapping.

Domain 3 (Figs. 7, 8): This domain is conspicuous by its generally strong and lineated RTMF signature that contrasts with the relatively negative signature of the parallel Domain 2 to the west. Much of the eastern margin of Domain 3 is defined by the contrast between the more northward-oriented trend of linear magnetic anomalies within the domain, specifically within the large Subdomain 3a, and northeastward-oriented trends in Domain 5 to the east observed in the derivative magnetic maps. This portion of the margin continues southward as the western margin of Domain 6, defined by more subtle differences in the trends within Subdomain 3a and Domain 6. It then truncates the western end of the narrow Domain 7 and finally swings south-southwestward where it is defined by the change from the strong positive expression of Subdomain 3a to the subdued expression of Domain 8 to the east. The latter portion, in part, coincides with the margin of the Athabasca basin.

The northeast corner of Domain 3 extends northeast as two narrow protrusions having overall relatively negative RTMF signatures and defined as Subdomains 3b and 3c. The larger Subdomain 3b is flanked by strong positive signatures of Domains 4 and 5, and is noticeably perturbed by several very narrow north-northwest-trending linear magnetic highs related to Mackenzie dykes (PMd) (Pehrsson et al., 2014a,b). Most of the subdomain is underlain by a NeoArchean and/or Proterozoic unit composed mainly of undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn) that extends well outside the southeast limit of the subdomain and underlies the greater part of adjacent Domain 5. The difference in magnetic expression of Subdomain 3b and Domain 5 clearly indicates a significant transition in some aspect of the geology along the mutual boundary. The negative signature of Subdomain 3c is disturbed by several linear to roughly linear, narrow east-northeast- to northeast-trending magnetic highs. The subdomain correlates closely with a unit of NeoArchean and/or Proterozoic unsubdivided high grade metasedimentary rocks (APTp) that include a variety of rock-types (Pehrsson et al., 2014a,b).

Subdomain 3a, forming the greater part of the domain, is dominated by a strong positive magnetic signature, but a conspicuous northeast-trending belt of generally subdued magnetic field is present near the northern end of the subdomain, though perturbed by several narrow, roughly northeast-trending linear magnetic highs. The belt correlates in large part with the Palaeoproterozoic metasedimentary Nonacho Group (PN), which is restricted to this area of the subdomain. Whereas the metasedimentary nature of the group could explain the negative aspects of the magnetic field, there does not appear to be any strong candidates, e.g., iron-formation, amongst the various listed rock-types to explain the highs. A few very narrow northeast-trending units of Nonacho Group falling within Subdomain 3b (Pehrsson et al., 2014a,b) indicate a former more extensive presence, supporting continuation of Domain 3 into this area.

Most of the main belt of positive RTMF defining Subdomain 3a correlates with the same unit of NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn) underlying the area of relatively negative magnetic field defining Subdomain 3b, again pointing to marked differences in mineralogical composition within different areas of this geological unit. Noticeable also is the close correlation between the strong positive RTMF signature along a narrow zone following the western margin of Subdomain 3a with granite, tonalite and quartz monzodiorite to diorite of the Talston magmatic suite (PTg). The magnetic properties of these western margin igneous rocks contrast strongly with the properties of adjacent similar Talston magmatic suite igneous rocks (PTg) that underlie much of the subdued magnetic signature defining Domain 2 to the west. The magnetic boundary between Domains 2 and 3 apparently signifies a major change in the composition of the Talston magmatic suite and/or a major structural break. The southern narrow segment of Domain 3 west of the Athabasca basin corresponds mainly with granite, tonalite and quartz monzodiorite to diorite of the Talston magmatic suite (PTg) (Pehrsson et al., 2014a,b).

Domain 4 (Figs. 7, 8): Domain 4 is a relatively narrow domain defined principally by a strong positive RTMF signature on the south side of the McDonald fault. It is subdivided into Subdomains 4a and 4b, separated by Subdomain 3c. Subdomain 4a displays elongate, linear highs trending generally between roughly N40^{O} and N60^{O} east that coincide variably with mainly units of (1) NeoArchean and/or Palaeoproterozoic tectonite, protomylonite to ultramylonite, straight gneiss and strongly foliated gneisses (APmy), (2) Proterozoic tectonite and highly laminated sheared rocks that include rectilinear, thinly layered gneiss or schist derived from plutonic or sedimentary protoliths (Pmy), and (3) Palaeoproterozoic Talston magmatic suite comprising granite, tonalite, and quartz monzodiorite to diorite (PTg). This subdomain truncates the north ends of Domains 1 and 2 and Subdomain 3a. The linearity of the subdomain is disrupted near its centre, where it is apparently dextrally displaced at least about 20 km along a fault trending roughly E5^{O}S from the McDonald fault.

Subdomain 4b is defined by an elongate wedge-shaped area of positive magnetic field trending overall about S30^{O}W from the McDonald fault, coinciding almost exclusively with a large unit of the Talston magmatic suite (PTg). A prominent short-wavelength magnetic high runs along the northwestern margin of the subdomain, but elsewhere a strong linear grain is not apparent. The broad area of magnetic high covering the rest of the subdomain, while disrupted by a series of sub-parallel linear magnetic lows attributed to faults and superposed roughly globular highs, does not display a strong uniform linear fabric, though some linear highs having principally northeast, east-northeast or northward trends are present. Some distinct narrow linear highs trending generally north-northwest correlate with mapped Mackenzie dykes (PMd) (Pehrsson et al., 2014a,b).

Domain 5 (Figs. 7, 8): The large northeast-trending Domain 5 is defined on the basis of its generally positive RTMF that contrasts with the characteristically relatively negative signatures of Domain 6 to the southeast and Subdomain 3b to the northwest, and its northeast-trending linear and fairly uniform magnetic grain exhibited in the derivative magnetic maps. Its western margin is defined by the truncation of its internal trends by the trends within Domain 3, and its northeastern extremity, lying within the Thelon basin, is positioned along the flanks of an area of predominantly linear northeast-trending RTMF highs bordered to the northwest, northeast and southeast by a subdued magnetic field. Noteworthy is the extremely close correspondence of the southeastern boundary of Domain 5 with the Manchester Lake – Howard Lake shear zone.

In detail, in the RTMF map, there is considerable variability in the nature of various areas of positive magnetic signature, and a few small areas of relatively negative signature are present. Notwithstanding this overall complexity in the magnetic signature, the geological map of Pehrsson et al. (2014a,b) shows the greater part of the domain to be underlain by NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn). It is evident that the magnetic field predicts that the geology is more complex than this single geological unit as defined at this stage of geological mapping.

A sizable unit of Early Palaeoproterozoic sedimentary sequences (Ps) extending southwestward from the Thelon basin adjacent to the Manchester Lake – Howard Lake shear zone includes quartzite, psammite, semipelite, carbonate, schists, gneisses, met-arkose and conglomerate and produces a positive magnetic signature indistinguishable from other areas of positive magnetic anomaly over NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn). The unit extends along roughly one-third of the southeastern margin of the domain, partially overlapping a narrow zone of NeoArchean and/or Palaeoproterozoic tectonite, protomylonite to ultramylonite, straight gneiss and strongly foliated gneisses (APmy) at its southwestern end. The latter unit extends over half the length of the southeastern margin of the domain in contact with, and sometimes enclosing, the Manchester Lake – Howard Lake shear zone. Its RTMF signature is generally relatively negative though sporadically perturbed by generally short, narrow linear highs parallel to the unit, some very narrow highs trending approximately north-northwest across the unit related to mapped Mackenzie dykes (PMd) (Pehrsson et al., 2014a,b), and some small (areally) globular highs. This mylonitic unit (APmy) is flanked to the northwest by a generally broader zone of NeoArchean and/or Palaeoproterozoic felsic-intermediate gneiss with abundant cataclastite and mylonite (APgnc). Its magnetic expression is variable, relatively positive in the southwest and relatively negative in the northeast. Apart from signatures of Mackenzie dykes no distinct linear pattern is discernible, but many small (areally) scattered globular highs locally give the relatively positive magnetic field a somewhat spotted appearance.

The clearest correlation between a mapped geological unit (Pehrsson et al., 2014a,b) and a RTMF anomaly within Domain 5 is a magnetic low that corresponds with a unit of ca. 1.85-1.79 Ga Palaeoproterozoic Hudson Suite granite (PHg) just west of the Thelon basin.

Domain 6 (Figs. 7, 8): Domain 6 is defined principally by its generally relatively negative RTMF signature that contrasts with the strong positive magnetic signatures of adjacent Domains

5 and 13 to the northwest, Domains 3 and 7 at the southwest end and Domain 10 to the southeast. The domain trends northeast in harmony with the trends of Domains 5 and 10. Although defined by a predominantly negative RTMF signature, some prominent positive magnetic features are present, notably at the southwest end of the domain, where irregular and discontinuous, linear to curvilinear belts of positive magnetic anomaly are relatively closely concentrated and parallel or sub-parallel to the curved southwest boundary of the domain. Distinct and fairly extensive linear belts of positive magnetic anomaly are observed also in the narrower northeastern half of the domain.

The dominantly positive magnetic expression in the southwest is replaced northeastward by a magnetic signature in which positive components are less intense and significant negative components are present, particularly within the central, widest part of the domain. Here, the subdued magnetic signature is disturbed by a superposed irregular linear fabric in which trends are variable, but generally northwestward, and include positive and negative elements. The net effect is a rough karst-like appearance of the RTMF. It is difficult to define a clear break in the magnetic field between this karst-like pattern and the more positive magnetic field to the southwest that might define subdomains. However, the magnetic derivative maps display a contrast between a broken northwest-trending linear fabric related to the karst-like pattern of the RTMF, and the more prevalent northeast trends within the principal area of positive signature to the southwest. There is a suggestion, therefore, of a change in geology that is reflected in the transition from a dominantly positive signature to a mix of weaker positive and negative signatures. Northeast of the karst-like pattern the magnetic field in the remainder of the domain is generally comparatively subdued, though punctuated by several areas of relatively positive magnetic signature in the northeastern, narrow section of the domain. A large area of subdued magnetic field lies immediately northeast of the karst-like magnetic pattern adjacent to, and skirting around, the prominent west-facing promontory of Domain 10 characterized by a very strong magnetic signature. The broader part of the subdued field displays hints of a weak, roughly northwest-trending, broken linear fabric in the derivative magnetic images, whereas to the northeast where the domain narrows a weak linear fabric oriented northeastward is discernible.

In the narrow northeastern portion of the domain two irregular linear belts of magnetic high trend northeastward within a subdued background. Their linear fabric is well displayed in the magnetic derivative maps. This northeast-trending fabric is discernible also in flanking subdued areas of the magnetic field. It is speculated that there is a change in geology between this area and the adjacent area of subdued RTMF to the southwest characterized by the broken northwest-trending linear fabric. However, a large mapped unit of Archean granulite-facies paragneiss, migmatite and diatextite (Adx) extends across both areas, and no fault is mapped along any potential boundary between the two areas (Pehrsson et al., 2014a,b). The geological relationship between these two areas of Domain 6, therefore, remains uncertain.

Many of the magnetic highs in the southwest corner of the domain are associated with mapped Archean granite to quartz monzonite intrusions (Agu) (Pehrsson et al., 2014a,b), though portions of these intrusions are relatively non-magnetic. Highs are also present over adjacent areas of NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn) that underlie most of the southwestern half of the domain. Quite small mapped areas of Early Palaeoproterozoic sedimentary sequences (PsH) and of NeoArchean and/or Palaeoproterozoic tectonite, protomylonite to ultramylonite, straight gneiss and strongly foliated gneisses (APmy) are also associated with magnetic highs.

The linear belts of magnetic highs in the northeast segment of the domain coincide with essentially two different rock units. The belt lying close to the northwestern margin displays a close relationship with a linear northeast-trending unit of Archean mafic-rich K-feldspar augen granodiorite to tonalite (Akg). This unit is surrounded by a unit of NeoArchean and/or Palaeoproterozoic foliated to mylonitic granite to granodiorite (APgr) that underlies most of the northeastern section of the domain southwest of the Thelon basin (Pehrsson et al., 2014a,b). The linear belt of magnetic highs close to the southeastern margin of the domain traverses mainly the latter unit (APgr) before extending into the Thelon basin.

Significant portions of the domain coinciding with the Thelon basin are characterized by a noticeably subdued and relatively smooth RTMF. Such a field covers a sizable area immediately southwest of Domain 13 near the Manchester Lake – Howard Lake shear zone, and smaller areas southeast of Domain 13. Elsewhere the field varies from weakly to moderately positive with superposed small (areally) scattered globular or short linear positive perturbations. The most conspicuous magnetic feature within the basin is a strong (many peak values >2000 nT and up to 2780 nT), narrow, north-northeast-trending linear high crossing the southwestern boundary and margin of the basin. This is a continuation of the most prominent high within a northeast-trending linear belt of magnetic highs traversing the unit of NeoArchean and/or Palaeoproterozoic foliated to mylonitic granite to granodiorite (APgr) immediately southwest of the basin. Right at the margin of the Thelon basin the high is flanked either side by units of NeoArchean and/or Palaeoproterozoic metasedimentary rocks (APsm), and a fault runs along its northwestern edge. This fault continues to flank the magnetic high within the Thelon basin (Pehrsson et al., 2014a,b). Based on the geological map of Pehrsson et al. (2014a,b), the source of this high is likely a strongly magnetic component of the mylonitic granite to granodiorite unit (APgr), though why such an intrusive component is so narrow and extensive (>50 km long) is puzzling.

Another prominent feature within the Thelon basin is a discontinuous linear RTMF high running roughly northeast along the southeastern boundary of Domain 13. Several peak values are >1000 nT, attaining about 1475 nT. Interestingly, this high lies along the projected path of the Manchester Lake – Howard Lake shear zone (Pehrsson et al., 2014a,b).

The small portion of Domain 6 lying outside the Thelon basin at its northeast extremity is characterized mainly by a slightly negative or neutral RTMF disturbed by scattered perturbations in the form of generally short and weak linear highs or small globular highs. Many narrow linear highs related to Mackenzie dykes (PMd) traverse the area. Several small (areally) globular highs, some moderately strong (peak values >1000 nT), occurring between the north shore of Dubawnt Lake and the Thelon basin, coincide with small areas of Archean mafic metavolcanic and related rocks (Amv) (Pehrsson et al., 2014a,b). This unit contains iron-formation that may be the principal source of the highs.

Domain 7 (Figs. 7, 8): Domain 7 flanking the southwestern end of Domain 6 is well defined on the basis of very strong RTMF anomalies, distinct trends of linear to curvilinear derivative anomalies and the frequency of occurrence of the latter. The magnetic highs have large amplitudes similar to those in adjacent Domain 10 to the southeast. However, the different patterns of the highs and truncation of some Domain 7 linears by Domain 10 distinguishes the two domains, whose mutual boundary follows closely the Black Bay fault, which traced southwestward traverses the interior of Domain 7. Along its southern margin Domain 7 is clearly differentiated from Domain 8 which correlates closely with the Athabasca basin. The basin is characterized by generally widely separated, smoother and longer wavelength magnetic highs.

Most of the domain west of the Black Bay fault is underlain by NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn), which collectively must be primarily responsible for the positive signature of the domain. The magnetic signature of the segment of Domain 7 southeast of the Black Bay fault is positive, but significantly weaker. In this area the geology is much more variable and represented by small units that include leucogranite and gneisses of the Talston magmatic suite (PTgl), megacrystic granite of the 2.35-2.30 Ga North Bay plutons (PNsg), sedimentary rocks and basalt of the Palaeoproterozoic Martin Group (PMR), sedimentary and volcanic rocks of the 2.30 Ga Murmac Bay Group (PMB), and MesoArchean granite-tonalite (Ab) (Pehrsson et al., 2014a,b).

The geology is also variable near the west end of Domain 7, between Athabasca and Tazin lakes, where relatively small units that include NeoArchean and/or Palaeoproterozoic metasedimentary rocks (APsm), Proterozoic tectonite and highly laminated sheared rocks (Pmy), Palaeoproterozoic massive anatectic granite and pelitic diatextite (PTga), and Palaeoproterozoic sedimentary rocks of the Nonacho Group (PNT, PNTc) are present.

Domain 8 (Figs. 7, 8): Domain 8 is defined on the basis of a relatively smoothly varying RTMF characterized by generally widely separated and relatively long wavelength magnetic highs. The smoothness and lack of short wavelength anomalies is attributed to the sedimentary cover of the northern margin of the Athabasca basin, which coincides closely with the domain.

Domain 9 (Figs. 7, 8): Domain 9 is defined primarily on the basis of its linear fabric and related textures, as displayed in the derivative magnetic maps, that contrast strongly with patterns of fabrics and textures in adjacent domains. It contains some strong RTMF highs exhibiting a linear fabric oriented generally east-northeast to northeast. These are set in a relatively neutral level of background magnetic field that itself displays a linear fabric having similar orientations. The domain continues from the exposed Rae craton southward into the Athabasca basin where its defining signature is still discernible in spite of some suppression of magnetic anomalies.

The section of the domain within the Rae craton coincides almost precisely with the East Athabasca mylonite triangle, described as a kinematically complex, deep crustal, multi-stage mylonitic structure (Hanmer et al., 1994). This is bounded to the northwest by the Grease River shear zone (Slimmon, 1989) and an accompanying brittle fault (Pehrsson et al., 2014a,b), and to the southeast by the Black-Bompas fault zone that runs along or near the western edge of the Legs Lake shear zone (Fig. 3) (Mahan et al., 2003). The Black-Bompas fault zone is depicted as a northwest-dipping thrust on the map of Pehrsson et al. (2014a,b).

The prominent positive linear RTMF anomaly in the northeast apex of the domain coincides with the northwestern margin of the northeast-trending MesoArchean Chipman batholith formed of highly strained gneiss that includes foliated to mylonitic tonalite and numerous xenoliths of amphibolite and pyroxenite (ACt), and which also contains a few narrow units of Chipman granulitic gneiss (ACmg). The eastern margin of the batholith is weakly magnetic though some low amplitude linear highs are discernible. The central area of the magnetic high that spans the boundary with the Athabasca basin correlates with Archean mafic gneiss, layered pyrobolite and norite (Ampn). Elsewhere the weakly magnetic portions of the domain correlate mainly with

Archean granulite-facies paragneiss, migmatite and diatextite (Adx), or with Archean foliated to mylonitic granite to granodiorite and granulite (Agf).

Domain 10 (Figs. 7, 8): Domain 10 is a very extensive northeast-trending domain running more or less along the spine of the Rae craton and defined by an overall positive RTMF signature. The intensity, texture and pattern of the positive signature are variable imparting a heterogeneity to the definitive signature of the domain that is heightened by comparatively small areas of weak magnetic field dispersed throughout the domain. In spite of the domain's overall northeast trend a uniform magnetic fabric displaying northeast trends of linear highs in the derivative images is not present. Linear features of any significant extent are essentially restricted to the northwestern margin south of the Thelon basin in Subdomains **a**, **b** and **d**.

Patterns in the derivative magnetic maps are dominated by mosaics of narrow linear to curvilinear positive anomalies that in several cases attain lengths greater than about 20 km, ranging exceptionally up to about 80 km. Some longer examples frequently narrow along their length with concomitant decrease in amplitude producing apparent discontinuities that may have slight offsets between them in the derivative magnetic images. Nevertheless these "discontinuous" linears reflect a single geological feature. Most linear magnetic highs are generally much shorter, less than about 15 km long, and many are shorter than 5 km. Some are roughly oval, globular or irregular in shape. They may be distributed in a linear manner, sometimes in series with longer linear features, or may be randomly positioned. All positive derivative linears stand out against an apparently uniform background level of the particular magnetic derivative. Patterns of this background level between the positive magnetic features resemble patterns of the positive features, in a sense reflecting patterns of weakly magnetic elements in the geology. Many narrow linear to curvilinear negative features are interpreted as expressions of faults.

Patterns of mosaics differ to varying degrees, sometimes subtly and sometimes more distinctively. In essence, the derivative map patterns are a mosaic of individual mosaics. Uniformity of length and of orientation of positive features within individual mosaics may vary. The problem of poorly levelled flight line data has some influence on the orientation of some positive linear features with the north-south flight-lines affecting the southern part of the domain and east-west flight-lines affecting the northern half. The mosaic patterns may be likened to karst topography, previously discussed, and are expressed as a "roughness" on the surface of the magnetic field.

Because of the large size and heterogeneity of the domain comprehensive descriptions of correlations of all geological units with magnetic signatures are not attempted. Descriptions of some of the more notable correlations follow. In the southwest of Domain 10 two areas of very strong RTMF anomalies are delineated as Subdomains 10**a** and 10**b**. Subdomain 10**a** runs along the section of the domain boundary marked by the Black Bay fault correlating in large part with a belt of NeoArchean tonalite, granodiorite and granite (Atg) that includes a large oval unit of NeoArchean and/or Palaeoproterozoic massive to poorly foliated mainly granite (APfn) (Pehrsson et al., 2014a,b). Farther from the boundary the subdomain correlates mainly with areas of NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn) and Archean gneissic granite to leucotonalite (Agl). Subdomain 10**b**, immediately northeast of Subdomain 10**a**, correlates overwhelmingly with an area of NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn) and with subsidiary areas of mainly NeoArchean and/or Palaeoproterozoic massive to poorly foliated mainly granite

(APfn) and Archean granulite grade amphibolite, mafic gneiss and layered to massive amphibolite, sedimentary rocks and banded iron formation (Amvg). Subdomain 10**c** on the southeast side of Subdomains 10**a** and 10**b** is characterized by a more variable magnetic field in which positive elements are prominent, but not as intense as within the latter two subdomains, and which includes some distinct areas of relatively negative signature. The geology is quite variable and includes areas of aforementioned units (Atg, Agl, APgn, APfn) and of Archean granulite-facies paragneiss, migmatite and diatextite (Adx), NeoArchean and/or Palaeoproterozoic hornblende quartzofeldspathic gneiss and migmatite (APmi) interlayered with biotite-amphibole gneiss (APdg), and Early Palaeoproterozoic sedimentary sequences (Ps). Close correlations of particular geological units with specific features of the magnetic field are rare, but there are two exceptions. One is correlation of a relatively negative north-south RTMF anomaly with Archean gneissic granite to leucotonalite (Agl) in the narrow constricted part of Subdomain 10**c**, though the western extension of this rock unit correlates with a positive magnetic expression, and the other is the correlation of prominent magnetic highs with small bodies of NeoArchean tonalite, granodiorite and granite (Atg) near the southern boundary of the subdomain with Domain 9.

Subdomain 10**d** is characterized by a strong positive RTMF expression, a significant portion of which occupies the nose of the protrusion of Domain 10 into Domain 6, where it correlates mainly with a unit of Archean granulite grade amphibolite, mafic gneiss and layered to massive amphibolite, sedimentary rocks and banded iron formation (Amvg). Elsewhere it correlates mostly with large areas of NeoArchean and/or Palaeoproterozoic massive to poorly foliated mainly granite (APfn) or foliated to mylonitic granite to granodiorite (APgr).

Subdomain 10**e** is a small unit-scale subdomain distinguished by a conspicuous negative signature that correlates very closely with a unit of Hudson Suite (~1.85-1.79 Ga) Hudson granite and related rocks (PHg). In stark contrast to the negative signature of the latter unit, two units of Hudson granite near the southeastern margin of the Thelon basin produce distinct positive RTMF anomalies used to define Subdomain 10**f** and Subdomain 10**g**.

An extensive area northeast of Subdomain 10**d** forming most of the remainder of Domain 10, and generally associated with a positive magnetic signature characterized by karst-like textures is designated as Subdomain 10**h**. The variety of textures and variability of the geology precludes a description of correlations between magnetic features and geology at this stage, and suffice to say that the principal (and generally larger) geological units contributing to the magnetic field include: NeoArchean and/or Palaeoproterozoic foliated to mylonitic granite to granodiorite (APgr), NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn), Archean granite to quartz monzonite intrusions (Agu), Archean mafic-rich, K-feldspar augen granodiorite to tonalite (Akg), and Palaeoproterozoic Christopher Island Formation that includes ultrapotassic lamprophyre (minette) lavas, breccias, and subaerial and subaqueous deposits (PBLc) (Pehrsson et al., 2014a,b), NeoArchean and/or Palaeoproterozoic mixed gneisses (APgn) and Palaeoproterozoic Nueltin Intrusive Suite porphyritic rapakivi granite (ca. 1.76 Ga) (PNg) (Tella et al., 2007), Archean Proterozoic mixed gneisses (APgn), NeoArchean Committee Bay and Woodburn Lake Groups pelite, psammite, wacke ± tuff ± quartzite (ACws), and Palaeoproterozoic Thelon Formation sandstone, pebbly sandstone and conglomerate (PBT) (Skulski et al., 2018).

Several discrete magnetic signatures near the northeast end of Domain 10 are designated as subdomains. Subdomain 10**i** is defined on the basis of a compact, prominent RTMF magnetic high having a uniformly developed karst-like texture. Its southeastern margin is near-coincident with the Snowbird tectonic zone as defined on the map by Tella et al. (2007). It correlates principally with Palaeoproterozoic Christopher Island Formation that includes ultrapotassic lamprophyre (minette) lavas, breccias and subaerial and subaqueous deposits (PBLc), and with porphyritic rapakivi granite (ca. 1.76 Ga) of the Nueltin Intrusive Suite (PNg) (Tella et al., 2007). Significant areas of NeoArchean tonalite comprising layered to banded orthogneiss that includes discontinuous layers and inclusions of other rock-types (At), and of the Palaeoproterozoic Pitz Formation that includes rhyolite and dacite flows, with sandstone and welded tuff (PWHp) are also present (Tella et al., 2007).

The small Subdomain 10**j** is defined by a conspicuous, singular, elongate oval-shaped RTMF high having a relatively smooth surface that extends across two geological units. One is formed of NeoArchean granodiorite (Agd) and the other of the NeoArchean Committee Bay and Woodburn Groups that include mafic and minor felsic volcanic rocks interbedded with iron formation, mafic tuffs, pelitic metasedimentary rocks, and felsic pyroclastic rocks (ACWmv) (Skulski et al., 2018). These units extend well beyond the limits of the defining magnetic high, where surprisingly their magnetic signals are relatively suppressed or weak.

Subdomain 10**k** at the extreme northeast end of the domain is characterized by a moderately strong RTMF having a karst-like texture that contrasts with a weaker and generally smoother magnetic field on all sides, except within the adjacent Domain 40 to the northeast, where a strong linear pattern of anomalies related to iron-formation is present. The subdomain correlates mainly with NeoArchean monzogranite and granite pegmatite of the ca. 2.61-2.58 Ga Snow Island Suite (Amg), though noticeably areas of stronger magnetic anomaly coincide with small units of ca. 1.76 Ga porphyritic rapakivi granite of the Nueltin Intrusive Suite (PNg) (Skulski et al., 2018).

The east-northeast-trending Subdomain 10**l** is conspicuous by its relatively smooth and negative RTMF signature that contrasts with the positive magnetic expressions of adjacent portions of Domain 10 and bordering Domains 17 and 30. The western two-thirds of the subdomain coincides mainly with Palaeoproterozoic sedimentary rocks of the Thelon Formation (PBT, Skulski et al., 2018; PBt, Tella et al., 2007) and rhyolite and dacite flows, sandstone and tuff of the Palaeoproterozoic Pitz Formation (PWP, Skulski et al., 2018; PWHp, Tella et al., 2007). The eastern third falls over the waters of the west end of Baker Lake.

Domain 11 (Figs. 7, 8): Domain 11 is a comparatively short (approximately 100 km long), narrow northeast-trending domain between Domains 10 and 12. It is considered worthy of domain status based on its significant contrasting trends of linear derivative magnetic anomalies with those of Domain 10 to the northwest, and contrast in texture of its RTMF with that of Domain 12 to the southeast. Its identification as a distinct portion of crust may have significance for the tectonic development of this region. The map of Pehrsson et al. (2014a,b) indicates that the domain coincides mainly with a variety of Early Palaeoproterozoic sedimentary rocks (Ps) transected by several very narrow northeast-trending bands of NeoArchean tonalite, granodiorite and granite (Atg) that apparently produce the linear derivative magnetic highs and counterparts in the RTMF image.

Domain 12 (Figs. 7, 8): Domain 12 is an extensive northeast-trending magnetic domain defined principally by the character of its RTMF, which displays a strong northeast-trending linearity of moderately wide belts of magnetic high irregularly alternating with belts of magnetic low or background levels of the field. The linearity of magnetic highs is locally disrupted by large-scale folding southwest of Snowbird Lake, where Pehrsson et al. (2014a,b) show narrow folded belts of NeoArchean tonalite, granodiorite and granite (Atg) set within Early Palaeoproterozoic sedimentary sequences (Ps) that cover much of the southwestern half of the domain. Here, these NeoArchean plutonic rocks (Atg) seem to be the main source of magnetic highs.

The linearity and folding are well displayed in the tilt and FVD images, which have also contributed to the definition of the domain. These images are responsible for the noticeable broadening of the central part of the domain near and south of Snowbird Lake, the pattern of linearity being distinct from patterns over the adjacent Hearne craton to the southeast. The broadening takes the southeastern margin of the domain some 20 km southeast of a shear zone and narrow tectonite unit (Pmy) along much of the northwestern boundary of the Chipman batholith (ACt) identified as part of the Snowbird tectonic zone (Pehrsson et al., 2014a,b). Thus the domain includes the MesoArchean Chipman batholith and even a narrow band of the Hearne craton. The batholith is included within the Rae craton (Pehrsson et al., 2014a,b). Domain 12 is subdivided into Subdomain 12**a**, the larger part of the domain, and Subdomain 12**b**, which is defined by more pronounced continuity and linearity of magnetic highs and coincides closely with the Chipman batholith and edge of the Hearne craton. The boundary between the subdomains falls essentially along the northwestern boundary of the batholith.

The southeastern margin of the narrow northeastern end of Subdomain 12a follows closely the Snowbird tectonic zone, marked in this area by a northwest-dipping thrust fault (Pehrsson et al., 2014a,b). The geology of this narrow section of Subdomain 12a, and of an adjacent section west of Snowbird Lake where the subdomain widens, is more variable than that of the southwestern section. Prominent RTMF highs in these sections coincide with Archean units of (1) granodioritic orthogneiss containing locally up to 40% mafic xenoliths (Ago), (2) granodiorite to tonalite (Agc), (3) gneissic granite to leucotonalite (Agl), (4) massive to foliated granodiorite to diorite (Agd), and (5) mafic-rich, K-feldspar augen granodiorite to tonalite (Akg) (Pehrsson et al., 2014a,b). Highs also coincide with a MesoArchean highly strained gneiss unit of Chipman batholith consisting of foliated to mylonitic tonalite containing numerous xenoliths of amphibolite and pyroxenite (ACt), and with NeoArchean and/or Palaeoproterozoic units of (1) mafic gneiss, amphibolite, gabbro, metagabbro, and peridotite (APmg), and (2) undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite along with minor metavolcanic and metasedimentary gneisses (APgn). Noticeable areas of relatively negative RTMF coincide with sizable bodies of Palaeoproterozoic porphyritic rapakivi granite of the ca. 1.76 Ga Nueltin Intrusive Suite (PNg) and Archean metasedimentary rocks (Ams) (Pehrsson et al., 2014a,b), though distinct magnetic highs are also associated with the latter unit.

Southwest of Snowbird Lake Domain 12 is underlain principally by Early Palaeoproterozoic sedimentary sequences (Ps) within which are distributed many, generally narrow, linear and curvilinear belts of NeoArchean tonalite, granodiorite and granite (Atg). Noteworthy occurrences of NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite (APgn), hornblende quartzofeldspathic gneiss and migmatite interlayered with biotite-amphibole gneiss (APmi) and foliated diorite to gabbro (APdg) are also present. Near the southwest end of the domain a short section of its southeastern margin follows the Grease River shear zone (Slimmon, 1989) and an accompanying brittle fault (Pehrsson et al., 2014a,b) that separate Domains 12 and 9.

Domain 13 (Figs. 7, 8): Domain 13 is defined primarily by a RTMF high located within the limits of the Thelon basin. The smooth appearance of the high reflects the burial of the probable source beneath the sedimentary fill of the basin. The overall trend is northeast, but the western portion of the high is more intense, oval-shaped and oriented north-south, suggestive of a separate, singular magnetic body, possibly a plutonic intrusion. This idea is supported by patterns of the derivative magnetic maps, which display some relatively short magnetic linears trending roughly east-northeast or N30^{O}E, and some scattered local irregularly-shaped magnetic highs within the northeastern portion of Domain 13. These patterns indicate a source(s) separate from the aforementioned potential oval plutonic intrusion to the west.

Domain 14 (Figs. 7, 8): Domain 14 is an irregularly-shaped domain sitting along the eastern margin of the main Thelon basin and overlapping basement to the east. It is distinguished by its moderately positive RTMF signature from the relatively smooth background field over adjacent Domains 6 and 69 to the west, and by the texture and magnetic patterns in the derivative images that contrast with counterparts in Domains 15 and 16 to the east. Its derivative texture may be described as a loose karst-like pattern with few extensive elements, and perhaps a northeast orientation predominating, but by no means a strong development. Flight-line levelling imperfections are also imaged as weak east-west discontinuous linears in the derivative magnetic images.

Those portions covering basement show reasonably close correlation with geological units. The southern portion coincides predominantly with Palaeoproterozoic porphyritic rapakivi granite of the ca. 1.76 Ga Nueltin Intrusive Suite (PNg) (Pehrsson et al., 2014a,b), and the northern portion mainly with metamorphosed Palaeoproterozoic supracrustal rocks that include pelites, marbles, metawacke gneisses and schists, and locally metabasalt, gabbro and quartzite (Ps3) and smaller areas of Palaeoproterozoic Pitz Formation (PWP) that includes rhyolite and dacite flows, sandstone and tuffs (Skulski et al., 2018).

Domain 15 (Figs. 7, 8): Domain 15 sits between the main part of the Thelon basin and the Aberdeen sub-basin and is defined by its karst-like patterns of RTMF and derivative magnetic features that tend to display a prevailing northeast-trending grain. Its RTMF expression is generally moderately positive, though it is relatively negative near its southeastern margin, an area where the karst-like pattern of features in derivative images is less well developed. The greater part of the domain correlates with a widespread unit of the Palaeoproterozoic Pitz Formation (PWHp, PWP) consisting of rhyolite and dacite flows, sandstone and tuffs (Pehrsson et al., 2014a,b; Skulski et al., 2018). This unit spans the dominantly positive expression of the domain and the relatively negative signature near the southeast margin, pointing to probable significant differences in the rock-types underlying the two contrasting signatures.

Smaller portions of the domain coincide mainly with units of (1) metamorphosed Palaeoproterozoic supracrustal rocks that include pelites, marbles, metawacke gneisses and schists, and locally metabasalt, gabbro and quartzite (Ps3) (Skulski et al., 2018), (2) Archean granite to quartz monzonite (Agu), (3) NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite together with minor metavolcanic and metasedimentary gneisses (APgn), and (4) undivided Early Palaeoproterozoic metasedimentary sequences (Ps) (Pehrsson et al., 2014a,b).

Domain 16 (Figs. 7, 8): Domain 16 near the eastern shore of Dubawnt Lake is differentiated from Domains 6 and 10 by its generally pervasive positive RTMF signature that contrasts visibly with adjacent relatively negative signatures present along the margins of those domains. It is differentiated from the more positive signatures of Domains 14 and 15 to the north by the well-developed, rough karst-like appearance of its RTMF that presents a pattern similar to that of braided streams. This braided linearity is well displayed in derivative magnetic images in which positive linear elements, some fairly extensive, are oriented predominantly north to north-northwest. Several correlate with mapped Mackenzie dykes (PMd) (Pehrsson et al., 2014a,b).

Geological maps (Pehrsson et al., 2014a,b; Tella et al., 2007) show some linear units, albeit in cases with irregular boundaries, oriented generally approximately north-northwest in harmony with the general pattern of the derivative images. The principal linear units are: (1) Palaeoproterozoic porphyritic rapakivi granite of the Nueltin Intrusive Suite (PNg) (Pehrsson et al., 2014a,b; Tella et al., 2007), (2) Archean quartz monzonite to granite (Agdm) (Pehrsson et al., 2014a,b), (3) NeoArchean coarse-grained, porphyritic quartz monzonite to granite (Agdm) (Tella et al., 2007), (4) Archean felsic intrusive rocks consisting of massive to slightly foliated granite to quartz monzonite (Agu), (5) NeoArchean and/or Palaeoproterozoic undifferentiated mixed gneiss, granite, orthogneiss and quartzofeldspathic migmatite, and minor metavolcanic and metasedimentary gneisses (APgn), (6) Palaeoproterozoic Christopher Island Formation comprising ultrapotassic lamprophyre (minette) lavas, breccias and subaerial and subaqueous deposits (PBLc) (Pehrsson et al., 2014a,b), and (7) Palaeoproterozoic Kanwak Formation composed of sandstone, siltstone and mudstone (PBLk) (Tella et al., 2007). The first three units, together, dominate coverage of the domain.

Domain 17 (Figs. 7, 8): Domain 17 is an elongate, east-northeast-trending domain lying partially along the south shore of Baker Lake, distinguished principally by the contrast of its magnetic derivative patterns with those of contiguous domains to the northeast and south, and by the contrast of its more positive RTMF expression with the more neutral or relatively negative values of neighbouring Domain 10 to the north. There is an internal contrast between the textures of the RTMF in the western and eastern halves. That in the west presents a slightly rough karst-like texture, whereas that in the east, where two sizable east-northeast-trending magnetic highs are present, essentially lacks a noticeable texture and variations in the field are much smoother; clusters of small (areally) but distinct circular to oval RTMF highs occur sporadically in the eastern half.

In spite of the noted textural contrast, the domain correlates almost exclusively with a very large unit and several small units of Palaeoproterozoic Christopher Island Formation consisting of ultrapotassic lamprophyre (minette) lavas, breccias and subaerial and subaqueous deposits (PBLc, PBLc) (Tella et al., 2007; Skulski et al., 2018). Smaller areas of the Palaeoproterozoic Thelon Formation comprising sandstone and conglomerate (PBT) and unsubdivided sedimentary South Channel, Kazan and Kunwak formations (PBL) (Skulski et al., 2018), and a few other geological units are also present.

Domain 18 (Figs. 7, 8): Domain 18 is an extensive (~340 km long), roughly northeast- to east-northeast-trending domain characterized by a dominantly positive RTMF signature running along the northwestern margin of the Archean Chesterfield block (Fig. 3). Its northwestern boundary follows closely the Snowbird tectonic zone as shown on the map by Tella et al. (2007) and its potential extension northeastward towards Baker Lake. Whereas the RTMF signature contributes to the definition of the domain, contrasts between the textures and patterns of derivative anomalies within the domain with counterparts outside the domain were the principal guides to delineating its boundaries. There is an irregular roughness to the RTMF throughout the domain, both within relatively positive and relatively negative areas. A strong linearity of trends within the RTMF is not obvious, though in a few places narrow linear highs impart a local northeast-directed grain to the field, perhaps best developed in the narrow southwestern portion of the domain. A sense of northeast-directed linearity is more obvious in the derivative images, though the extent of most linear elements is generally limited, and a northeast orientation does not prevail everywhere.

Correlation with geology varies along the length of the domain. In the southwestern portion of the domain, west of Yathkyed Lake, the domain coincides in large part with NeoArchean tonalite in the form of banded orthogneiss that includes discontinuous layers of semipelite/psammite and possibly abundant inclusions of metamafic rocks and quartz-magnetite iron-formation (At), and with Palaeoproterozoic Christopher Island Formation consisting of ultrapotassic lamprophyre (minette) lavas, breccias and subaerial and subaqueous deposits (PBLc) (Tella et al., 2007). Northeast of the lake, the aforementioned tonalite unit is once again one of the main geological units along with NeoArchean layered orthogneiss (Agn) and NeoArchean coarse-grained K-feldspar augen granite and quartz monzonite (Ag) (Tella et al., 2007). Several sizable bodies of Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg) are scattered throughout this northeastern segment of the domain, though typically they are not associated with pronounced RTMF signatures.

Domain 19 (Figs. 7, 8): Domain 19 is defined by its generally relatively negative RTMF signature and the texture of its derivative images. It lies partially along the southeast side of Domain 18, is flanked mainly by Domain 20 to the southeast, wrapping around the southwest end of this domain in which area it is flanked by Domain 21 to the southeast. Whereas the overall trend of the domain is northeast, individual elements in the derivative images, if linear, are generally short and few are oriented in the northeast direction, with eastward, southeastward and east-southeastward trends being observed in various sectors of the domain. Many elements are globular, lacking any marked extension, and generally all elements are not closely concentrated. These characteristics contrast strongly with the predominantly northeast trends of linears in adjacent domains, which tend to be significantly more extensive and tightly concentrated.

The portion of the domain adjoining Domain 18, like the southwestern portion of that domain, coincides mainly with NeoArchean tonalite (banded orthogneiss containing discontinuous layers of semipelite/psammite and possibly abundant inclusions of metamafic rocks and quartz-magnetite iron-formation) (At), and Palaeoproterozoic Christopher Island Formation comprising ultrapotassic lamprophyre (minette) lavas, breccias and subaerial and subaqueous deposits (PBLc) (Tella et al., 2007). The portion wrapping around the southwestern extremity of Domain 20 coincides principally with NeoArchean metasedimentary rocks that include pelite and psammite that may be accompanied by schist and paragneiss (ARs) (Tella et al., 2007).

Domain 20 (Figs. 7, 8): Domain 20 is defined by a generally strong, northeast-trending belt of RTMF high that stands out in comparison to the more subdued fields of flanking Domains 19 and 21. The high is more strongly developed along the northeastern two-thirds of the domain, being relatively subdued farther southwest. Where the broad belt of positive expression is strongest, superposed narrow, northeast-trending linear highs are observed, and these display as a series of narrow, closely spaced highs in the derivative magnetic maps. In the southwest, where the magnetic field is weaker, distinct linear derivative highs are also present, but these trend east-southeast. The change in patterns and of intensity of the RTMF apparently takes place along an east-west mapped fault (Tella et al., 2007) expressed in the magnetic field as a linear magnetic low.

The greater part of the domain northeast of the fault is underlain mainly by NeoArchean tonalite made up of orthogneiss that includes layers of semipelite/psammite and may contain inclusions of metamafic rocks and quartz-magnetite iron-formation (At); these rocks continue for a short distance southwest of the fault (Tella et al., 2007). The southwestern extremity of the domain coincides largely with NeoArchean metasedimentary rocks such as pelite and psammite (ARs), though a few small circular bodies of NeoArchean coarse-grained K-feldspar augen granite and quartz monzonite (Ag) are also present (Tella et al., 2007).

Domain 21 (Figs. 7, 8): Domain 21 is a relatively narrow, northeast-trending domain extending roughly 240 km along the southeastern margin of the Chesterfield block, with its southeastern margin generally near-coincident with the Tyrell shear zone (Tella et al., 2007). The RTMF signature of the domain is variable, values ranging from moderately positive to background or weakly negative, and makes a limited contribution to definition of the domain. However, narrow linear northeast-trending magnetic highs are viewed throughout, their definition being significantly enhanced in the derivative magnetic maps. They produce a reasonably uniform pattern of linears having a fairly consistent lateral separation that sets it apart from surrounding patterns.

The linearity in magnetic features reflects the linearity of several narrow to moderately wide geological units, notably (1) NeoArchean tonalite present as layered to banded orthogneiss (At) that includes layers and inclusions of other rock-types, (2) NeoArchean coarse-grained K-feldspar augen granite and quartz monzonite (Ag), (3) NeoArchean layered orthogneiss (Agn), (4) NeoArchean amphibolite (ARm), (5) NeoArchean undifferentiated mafic-intermediate volcanic rocks (ARmu), (6) NeoArchean metasedimentary rocks that include pelite/psammite and possibly alumino silicate schist/paragneiss (ARs), and (7) NeoArchean and/or Palaeoproterozoic partly gneissic granodiorite (APgd) (Tella et al., 2007). Each of the aforementioned units individually generally displays a variable magnetic expression that includes narrow linear magnetic highs, narrow linear magnetic lows and general background levels of the RTMF. Broader areas of relatively negative or background level magnetic field are noticeable at the southwestern end of the domain associated with units ARs, ARmu and Agn, previously described, and with a unit of Adt consisting of NeoArchean tonalite to diorite (Tella et al., 2007). An elongate, north-northeast-trending oval body of Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg) in the southwestern half of the domain is noticeable for its associated positive magnetic field. The RTMF highs throughout the domain are generally comparatively weak. The geology of this domain is somewhat exceptional in the nature of its linear units extending over such relatively large distances.

Domain 22 (Figures 9, 10): Domain 22 is a northeast-trending, moderately wide domain having variable RTMF characteristics similar to those of Domain 21, with RTMF values ranging from weakly positive to background. In similar fashion, too, it displays some narrow linear magnetic highs, but of more moderate extent and less concentrated. It is defined primarily by its pattern of mainly northeast-trending linear anomalies in the derivative magnetic images. This northeast trend contrasts markedly with trends of linear anomalies observed outside of the domain, with the exception of trends of adjacent linears in the Hearne craton to the southeast, which are parallel to sub-parallel. Hence definition of the southeastern boundary is more difficult, but

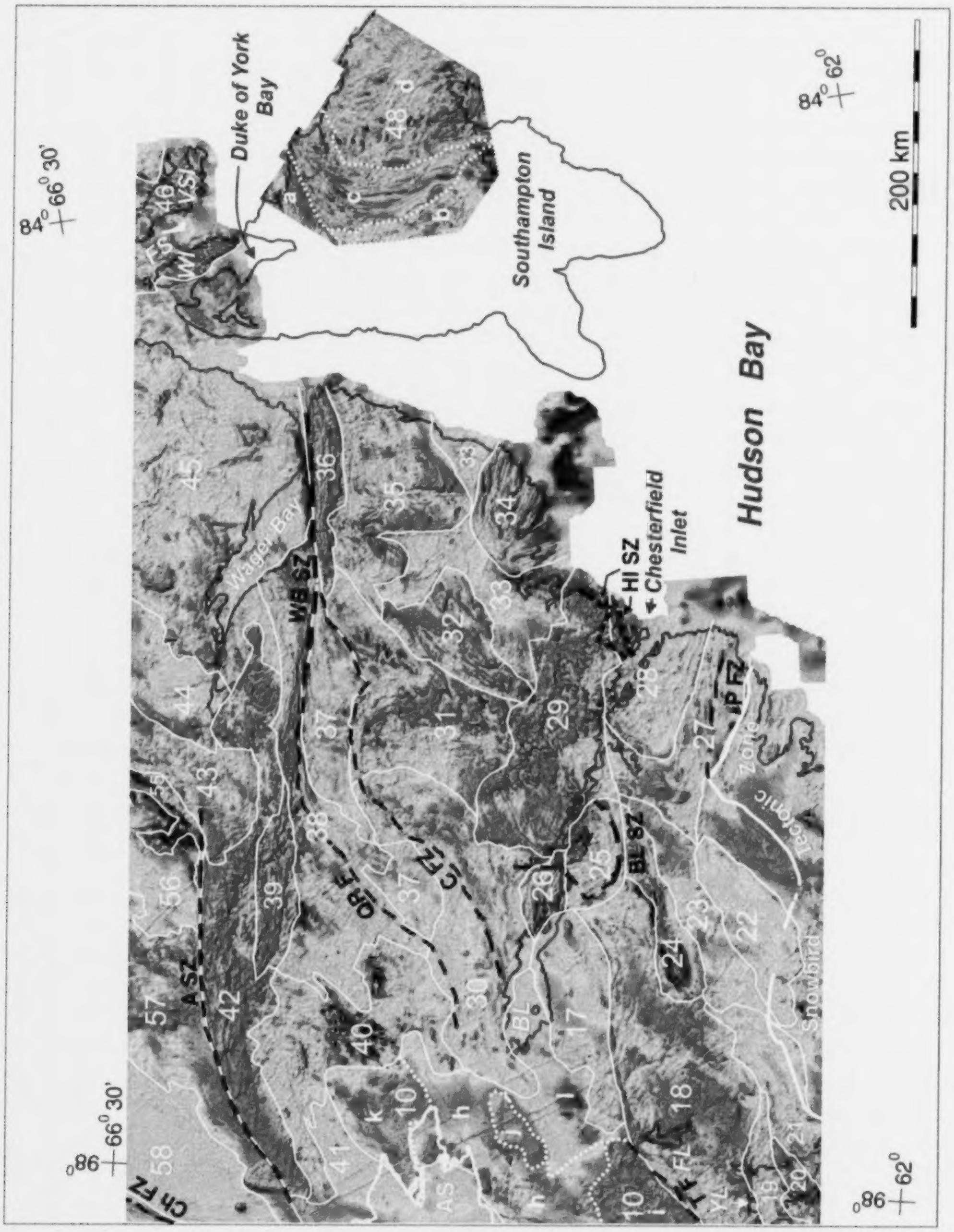
Duke of York Bay
Southampton Island
Hudson Bay
Chesterfield Inlet
HI SZ
Wager Bay
WB SZ
QR F
C FZ
BL SZ
P FZ
A SZ
Ch FZ
T F
Snowbird
tectonic
zone
BL
FL
YL
AS
WI
FS
VSI
200 km
84° 66° 30'
84° 62°
86° 66° 30'
86° 62°
a
b
c
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Figure 9: Map of residual total magnetic field for southeastern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: AS, Aberdeen sub-basin; A SZ, Amer shear zone; BL SZ, Big Lake shear zone; C FZ, Chesterfield fault zone; Ch FZ, Chantrey fault zone; HI SZ, Hanbury Island shear zone; P FZ, Pyke fault zone (forms part of Snowbird tectonic zone); QR F, Quoich River fault; T F, Tulemalu fault; WB SZ, Wager Bay shear zone. Lakes and other geographical features: BL, Baker Lake; FL, Forde Lake; FS, Frozen Strait; VSI, Vansittart Island, WI, White Island; YL, Yathkyed Lake.

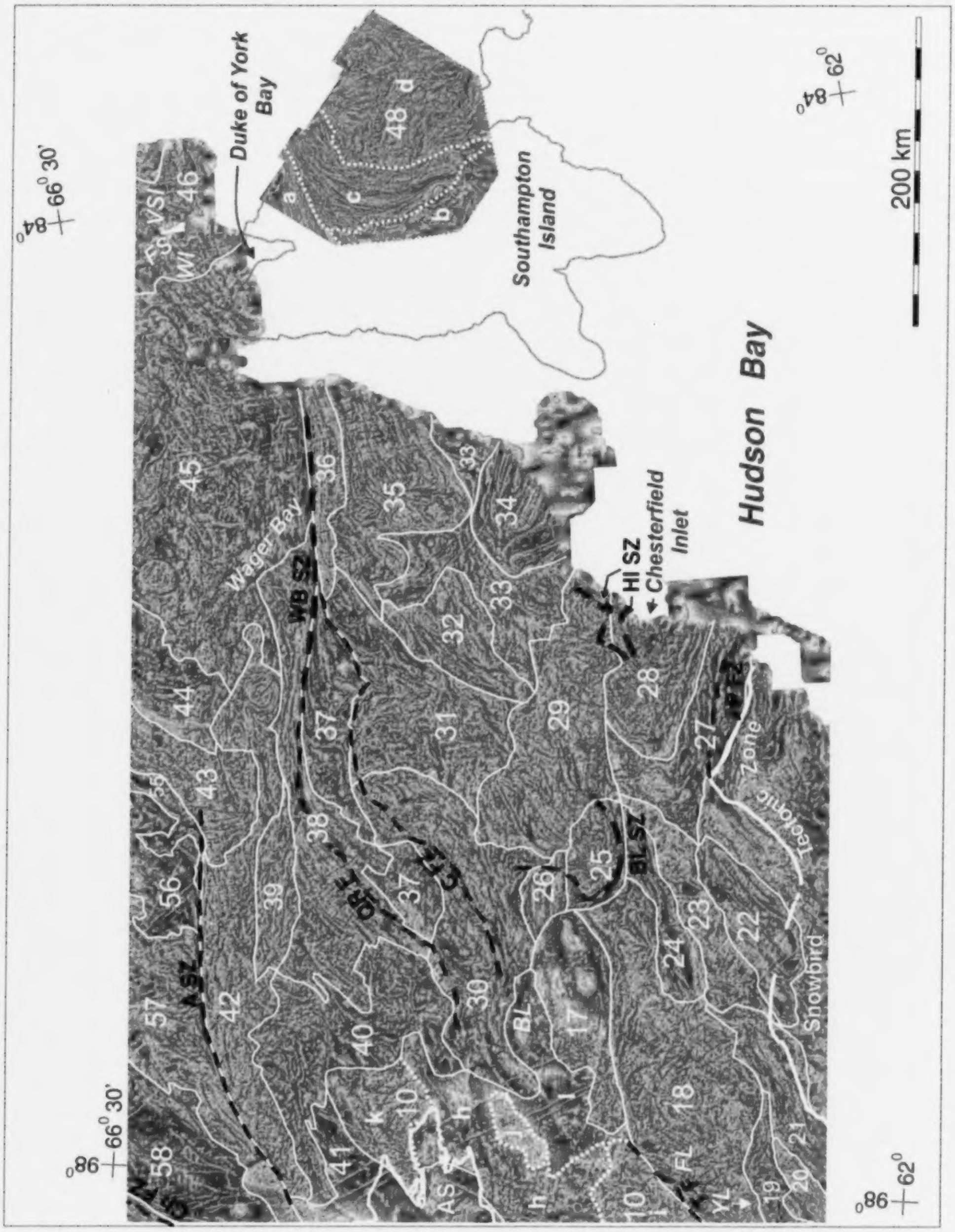
Duke of York Bay
Southampton Island
Hudson Bay
Chesterfield Inlet
HI SZ
Wager Bay
WB SZ
QR F
C FZ
BL SZ
A SZ
P FZ
Snowbird Tectonic Zone
VSI
WI
FS
BL
FL
YL
AS
200 km
84°
66° 30'
98°
62°

Figure 10: Map of tilt of residual total magnetic field for southeastern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: AS, Aberdeen sub-basin; A SZ, Amer shear zone; BL SZ, Big Lake shear zone; C FZ, Chesterfield fault zone; Ch FZ, Chantrey fault zone; HI SZ, Hanbury Island shear zone; P FZ, Pyke fault zone (forms part of Snowbird tectonic zone); QR F, Quoich River fault; T F, Tulemalu fault; WB SZ, Wager Bay shear zone. Lakes and other geographical features: BL, Baker Lake; FL, Forde Lake; FS, Frozen Strait; VSI, Vansittart Island, WI, White Island; YL, Yathkyed Lake.

demarcation is aided by a large prominent RTMF anomaly lying southeast of the proposed boundary that serves to distinguish areas of contrasting crustal properties.

Domain 22 is slightly offset southward from the northeast end of Domain 21. Based on the patterns and characteristics of magnetic field in the wider region around the domain, it is speculated that the domain forms an element of the Chesterfield block rather than of the Hearne craton. The geology of the domain is dominated by (1) NeoArchean tonalite in the form of layered to banded orthogneiss (At) that includes layers and inclusions of other rock-types, and (2) several elongate, roughly oval-shaped, northeast-trending bodies of Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg) (Tella et al., 2007). Both of these units have a variable RTMF expression. The sources of the conspicuous narrow magnetic highs, most of which sit within the NeoArchean tonalite unit (At), are not evident, but doubtless are related to the noted included layers within the orthogneiss.

Adjacent Domain 23 to the north and a large portion of the adjacent Hearne craton also are formed predominantly of units of NeoArchean tonalite (At) and Palaeoproterozoic granite and monzogranite (PHg), yet the differences in magnetic expression suggest substantial differences in the internal structural fabrics and some variability in rock-types.

Domain 23 (Figures 9, 10): Domain 23 is essentially a collinear northeastward extension of Domain 21, but unlike the latter domain its magnetic field lacks a discernible internal northeast-oriented linear fabric. The domain is defined by the distinction of its magnetic fabric as expressed in the derivative magnetic images compared to fabrics of the surrounding domains. This fabric is somewhat disorganized in the sense that linears are generally not very extensive and of variable trend, producing a karst-like pattern.

The RTMF has no notable characteristics in terms of anomalies or fabric. Most of the domain is dominated by irregular areas of magnetic high that range from weakly to moderately positive, with some small areas of background level field present. There are a few examples of superposed narrow linear highs. Some of the more extensive are located in the southwest half of the domain where they trend generally roughly west-northwest to northwest. Two of the northwest-trending linears correlate with mapped Mesoproterozoic, ca. 1.27 Ga, Mackenzie dykes (PMd) (Tella et al., 2007), and others may be related to dykes. Several shorter narrow linear highs in this area are oriented approximately between north-northwest to north-northeast.

An extensive belt-like and fairly broad unit of Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg) (Tella et al., 2007) traversing the length of the domain is associated with most of the positive RTMF response. However, there is no clear correlation of this response with the southwestern two-thirds of this unit, the boundaries of the granitic body lacking any associated magnetic signature. In contrast, the northern third of the unit produces a noticeably stronger and more cohesive response, correlating more closely with a large continuous area of distinct positive magnetic anomaly. Superposed linear RTMF highs are not conspicuous within this broad magnetic high and those that are discernible usually having limited extent and various orientations. Smaller areas of NeoArchean tonalite (orthogneiss) (At) peripheral to the Hudson Suite granite (PHg) tend to be associated with various levels of the magnetic field in the domain, including the lowest background levels.

Domain 24 (Figures 9, 10): Domain 24 has a defining magnetic signature that is conspicuous by the intensity of some of its narrow linear magnetic highs in the RTMF image and the overall linearity of the pattern of anomalies displayed in the derivative magnetic images. These anomalies trend east-northeast mimicking the overall trend of the domain and contrasting sharply with the orientation of linears in adjacent domains.

Geological mapping in this part of the compilation map of Tella et al. (2007) apparently is more detailed in spite of extensive Quaternary cover over the west-southwestern portion of the domain. The main bedrock unit in this part of the domain apparently is NeoArchean tonalite (orthogneiss) (At) that includes layers of semipelite/psammite (As), and may contain inclusions of metamafic rocks (Av) and remnants of quartz-magnetite iron-formation (Aif). The orthogneiss unit is traversed by narrow, east-northeast-trending linear bands of NeoArchean metasedimentary rocks that include pelite/psammite and may include schist/paragneiss (ARs), and NeoArchean volcanic rocks that are predominantly mafic and contain subordinate intercalated volcaniclastic rocks (ARv). Near the western limit of the domain seven occurrences of banded quartz-magnetite iron formation (Aif) are shown by Tella et al. (2007), five of which sit on or at the edge of major linear RTMF highs. However, the occurrences are short, generally between about 1000 m and 2000 m long, and only 300 m or so wide, whereas the highs are much more extensive and wider. The principal magnetic high extends almost the entire length of the domain with peak values attaining as much as 8000 nT suggesting a wider presence of iron formation than indicated by the few examples mapped near the western end. This high and shorter intense highs display a close association with bands of NeoArchean metasedimentary rocks that include pelite/psammite and may include schist/paragneiss (ARs). Because the few mapped occurrences of iron formation fall within this metasedimentary unit (ARs) it is proposed that such occurrences, as yet unmapped, are present along the lengths of these intense linear magnetic highs.

The northern boundary of Domain 24 lies generally about 2.5 to 4 km south of the Big Lake shear zone (Tella et al., 2007). Considering that the boundary is positioned on the basis of changes in the patterns of linear elements in the derivative magnetic images it might have been expected that the path of change would have coincided with the shear zone. It seems that activity along the shear zone has resulted in structural changes reflected in the magnetic field that extend south of the shear zone, and which maintain a parallelism with the zone.

Domain 25 (Figures 9, 10): Domain 25 is bordered by 5 other domains, and distinguished principally by its contrasting pattern of linear magnetic highs as displayed in the derivative magnetic images. Delineating the boundary with Domain 29 to the north was somewhat tenuous, but completed with the aid of the RTMF image that indicates a very much stronger field in Domain 29. Trends of the derivative linear magnetic highs in the western half of the domain are generally oriented roughly northwest to north-northeast, contrasting with those in the east, which are generally directed approximately east-northeast.

Most of the domain coincides with the portion of the Cross Bay complex (Fig. 1) south of Chesterfield Inlet that includes NeoArchean units of (1) tonalite to granodiorite (ACBt), (2) gneissic diorite to gabbro (ACBdi), (3) South Channel granodiorite (ACBg), and (4) Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg) (Tella et al., 2007). The complex is bounded to the south by Palaeoproterozoic straight gneiss of the narrow Big Lake shear zone consisting of mylonites derived principally from tonalite to granite protoliths (Pgm).

South of the complex, the southern margin of Domain 25, and also its southwestern margin, coincides with NeoArchean tonalite (orthogneiss) (At) that includes layers of semipelite/psammite and may include inclusions of metamafic rocks and quartz-magnetite iron-formation. This marginal tract is characterized generally by a relatively subdued RTMF, though some weak and some strong linear magnetic highs of limited extent are observed. The occurrence of other small geological units near or within the limits of some magnetic highs indicates that the NeoArchean tonalite may not be the only contributor to these anomalies.

In the northwest corner of the domain a small area of NeoArchean felsic to intermediate volcanic rocks (Af) (Tella et al., 2007) correlates with low RTMF values, and an adjacent small area of NeoArchean metasedimentary rocks that include pelite/psammite and possibly schist/paragneiss (ARs) is associated with a short, linear magnetic high.

Domain 26 (Figures 9, 10): Domain 26 is a small domain delineated by its strong RTMF expression that contrasts sharply in intensity, pattern, texture and orientation of linear anomalies with counterparts in neighbouring domains. Several parallel, linear magnetic highs having an overall east-west orientation, but gently arcuate form convex towards the north, define this residual total field expression.

The domain correlates very closely with a distinct assemblage of rock-types at the east end of Baker Lake forming the Palaeoproterozoic Kramanituar complex (Fig. 1) (Skulski et al., 2018). Most are distributed as a series of narrow bands having trends simulating those of the magnetic highs and intervening lows. The rock-types are assigned to five rock units: (1) anorthosite and anorthositic gabbro (PKa), (2) gabbro and metagabbro (PKg), (3) charnockite and garnet leucogranite with gabbro ± leucogabbro (APKc), (4) equigranular gabbro and diorite (APKdg) and (5) granulite (APKgp). Small areas of NeoArchean monzogranite and granite pegmatite (Amg) and granodiorite (Agd) of the Snow Island Suite are present along the northern margin of the domain, and NeoArchean undifferentiated granitoid rocks (Agu) underlie the eastern margin.

Noticeably, a narrow linear RTMF low correlates closely with a band of anorthosite and anorthositic gabbro (PKa) in the southern part of the complex, and a broader linear low in the northern part correlates with portions of units of anorthosite and anorthositic gabbro (PKa) and granulite (APKgp), though other areas of these units are associated with prominent magnetic highs.

The Kramanituar complex disappears westward under the waters of Baker Lake, where it is also covered by Palaeoproterozoic sandstone, pebbly sandstone and conglomerate (PBT) of the Thelon Formation mapped on several islands within the east end of the lake.

Domain 27 (Figures 9, 10): Domain 27 is defined by its marked differences in the patterns and textures of features in the derivative magnetic maps compared to those in adjacent domains. In particular, magnetic highs, several of which are linear and fairly extensive are not as tightly concentrated as in adjacent domains, and their orientations may differ significantly. Characteristics of the RTMF contribute little to definition of the domain.

The shape of the domain is noteworthy as it wraps around the western and southern edges of Domain 28, which correlates closely with a large area of NeoArchean tonalite in the form of layered to banded hornblende-biotite orthogneiss (ARt) (Tella et al., 2007). Domain 27 runs west-northwest from the coast of Hudson Bay flanking the tonalite before swinging abruptly north-northeast along the western margin of the tonalite and finally terminating just south of Chesterfield Inlet. Both the western and southern margins of the tonalite are marked by faults, and these portions of the domain boundary follow closely the paths of these faults. The southern boundary of Domain 27 in the area south of the tonalite follows very closely the Pyke fault zone (Fig. 3) as far west as the zone has been mapped (Tella et al., 2007). It then traverses an area of Quaternary cover and then a unit of NeoArchean tonalite (layered to banded hornblende-biotite orthogneiss) that includes semipelite/psammite and may include inclusions of metamafic rocks and quartz-magnetite iron-formation (At). The Tyrell shear zone (Fig. 3) marks the boundary between the Chesterfield block and Hearne craton further to the west-southwest, and may link with the Pyke fault zone (Tella et al., 2007; Berman et al., 2007). If this supposition is correct then it is reasonable to suggest that Domain 27 forms the southern margin of the Chesterfield block. It has been noted in the section on **Major Faults** that the Tyrell shear zone possibly forms part of the Snowbird tectonic zone (Pehrsson, personal communication, 2017). This tectonic zone is plotted on Figures 9 and 10, running along much of the southern boundary of Domain 27.

The west-northwest-trending portion of Domain 27 south of Domain 28 is characterized by several prominent linear sub-parallel magnetic highs in all magnetic images that exhibit close correlation with narrow units of NeoArchean metasedimentary rocks comprising pelite/psammite with or without schist/paragneiss (ARs), or fall within broader units of the same. They trend generally obliquely across the domain, striking roughly east-west or west-northwest, and are fairly widely separated. The east-west trend mimics that of some narrow elongate bodies of NeoArchean and/or Palaeoproterozoic biotite-muscovite leucogranite (APgm) that fall within the general area of metasedimentary rocks (Tella et al., 2007).

The north-northeast-trending arm of the domain is underlain mainly by NeoArchean tonalite (hornblende-biotite orthogneiss) that includes semipelite/psammite and may include inclusions of metamafic rocks and quartz-magnetite iron-formation (At), and several invading bodies of Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg) in the northern portion (Tella et al., 2007). These igneous bodies (PHg), or portions of them, are invariably associated with a strong positive magnetic signature, whereas the tonalite (At) correlates generally with a more subdued magnetic field. In places, generally narrow units of NeoArchean metasedimentary rocks (ARs), separate units of tonalite (At) or granite and monzogranite (PHg).

Domain 28 (Figures 9, 10): Domain 28 is a coastal domain defined by its pattern of derivative magnetic linear and curvilinear magnetic highs, many of which are prominent in the RTMF image. These highs seem to reflect two large juxtaposed geological bodies. One proposed body is located in the northern two-thirds of the western part of the domain, where the highs are distributed in an oval-shaped concentric pattern whose axis is oriented roughly N60^{O}E. In the eastern part of the domain an arcuate pattern of highs defines the western half of an apparent peripheral zone of a large oval-shaped body whose axis trends west-east. Patterns of magnetic highs within this proposed body are more irregular, and any eastward continuation is not apparent as magnetic coverage terminates at the coast. The two areas of described arcuate patterns are bordered by relatively narrow belts of linear highs running parallel to the western and southern boundaries of the domain. The RTMF is noticeably more positive in the northwestern and northern marginal areas of the domain.

The domain correlates closely with a large area of NeoArchean tonalite (layered to banded hornblende-biotite orthogneiss) (ARt) lying south of Chesterfield Inlet and small areas along the north shore of the inlet (Tella et al., 2007). Near the centre of the western oval magnetic pattern the tonalite (ARt) apparently is intruded by NeoArchean quartz diorite to granite plutons (ARgq), two of which near the south shore of Chesterfield Inlet are separated by an extremely narrow band of NeoArchean metasedimentary rocks (ARs) that completely surrounds one of the plutons. Together these plutons and the metasedimentary rocks form a roughly heart-shaped group. It is speculated that this group could form the core of a larger pluton that is largely buried by the NeoArchean tonalite (ARt) and that the concentric magnetic pattern represents zoning within the buried pluton. An elongate intrusion of NeoArchean quartz diorite to granite (ARgq) south of the proposed core correlating with magnetic linears forming part of the western concentric pattern is consistent with this possibility. Again, without knowledge of the exact timing of the formation of units ARt and ARgq, it is possible that they were intruded during the same igneous event, representing different phases of intrusion, and the outer concentric linears could relate to the tonalite phase (ARt).

A narrow band of NeoArchean amphibolite (ARm) wedged between bands of NeoArchean metasedimentary rocks (ARs) in the northwest corner of the domain is associated with a prominent linear magnetic high. This high apparently is terminated at the margin of a sizable cross-cutting pluton of Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg), which imparts its presence on the RTMF, apparently in the form of several small globular and relatively short linear magnetic highs. Two of the latter highs are roughly collinear with the high related to amphibolite, running close to the western margin of the domain, inviting speculation that their source may be the amphibolite (ARm) at shallow depth beneath a thin Hudsonian Suite intrusion (PHg).

Gently arcuate linear magnetic highs along the western edge of the eastern concentric pattern correlate with a narrow, gently arcuate unit of NeoArchean augen granite and quartz monzonite (ARg), possibly implying that this rock-type may be more widely distributed within the area mapped as NeoArchean tonalite (hornblende-biotite orthogneiss) (ARt) and/or possible zoning within the latter, of which the augen granite and quartz monzonite (ARg) represents one component. On the north shore of Chesterfield Inlet peripheral magnetic linears of the eastern concentric pattern run along the length of a NeoArchean and/or Palaeproterozoic granulite (anorthosite protolith) unit (APHIsz) of the Hanbury Island shear zone (Tella et al., 2007). The zone is interpreted to be a synformal shear zone representing a deformed remnant of a ductile thrust (Tella and Annesley, 1988).

Domain 29 (Figures 9, 10): Domain 29 runs west-northwest from the coast truncating Domains 31, 32 and 33 to the northeast, which trend in a northeast direction. Its southern margin contacts Domains 23 and 25 through 28, and its western margin is bounded by Domain 30. It is defined principally by its generally strong RTMF signature that stands out against weaker fields in surrounding domains. Its west-northwest trend is an anomalous trend in this part of the Rae craton. Differences in trend direction, intensity and texture of derivative anomalies (tilt and first vertical derivative) also contribute to definition of this domain.

It is noted that there is a significant difference in the detail of the geological mapping within the domain north (Skulski et al., 2018) and south (Tella et al., 2007) of latitude 64^{O}N, which virtually divides the domain into southern and northern halves.

Magnetically, approximately the western third of the domain is distinguishable from the rest of the domain by a series of narrow, roughly northeast- to east-northeast-trending parallel to sub-parallel linear anomalies that have more continuity than linear anomalies further east. Most of this portion of the domain lies north of latitude 64^{O}N falling on the geological map compiled by Skulski et al. (2018) that shows ubiquitously NeoArchean undifferentiated granitoid rocks that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite (Agu). The magnetic patterns indicate that this area contains many linear geological units having diverse magnetic susceptibilities that probably signify different rock-types. A very few isolated northeast-trending, narrow and not very extensive volcanic (ACWmv) and sedimentary (ACWs) units of the NeoArchean Committee Bay and Woodburn groups are present within this granitoid terrain, their trends conforming with the magnetic patterns.

Much of the western third of the domain south of latitude 64^{O}N falling on the locally more detailed geological map compiled by Tella et al. (2007) displays an overall relatively subdued RTMF, locally coinciding mainly with units, or portions thereof, of NeoArchean tonalite (hornblende-biotite orthogneiss) (ARt), metasedimentary rocks (ARs), tonalite to granodiorite (ACBt) of the Cross Bay plutonic complex (Fig. 1), and NeoArchean and/or Palaeoproterozoic mylonitic layered anorthosite mafic granulite of the Uvauk complex (Fig. 1) (APUcx). Positive signatures within this area of generally subdued field are observed within the latter unit of the Uvauk complex, within units of Palaeoproterozoic granite and monzogranite of the Hudson Intrusive Suite (PHg), and NeoArchean units of tonalite (hornblende-biotite orthogneiss) (At), gabbro and metagabbro (ARgb), tonalite to granodiorite (ACBt) of the Cross Bay plutonic complex (Fig. 1) and granodiorite of the South Channel granodiorite (ACBg) belonging to the same complex. The western margin of the domain immediately south of latitude 64^{O} coincides with an area of strong positive RTMF correlating with tonalite to granodiorite (ACBt) of the Cross Bay plutonic complex and displaying superposed parallel northeast-trending linear highs. These highs extend for a significant distance northeastward into the broad area of NeoArchean undifferentiated granitoid rocks (Agu) displayed on the map compiled by Skulski et al. (2018), indicating that the Cross Bay plutonic complex may underlie a large portion of this area.

The remaining eastern portion of Domain 29, while having a strong presence of east-northeast- to north-northeast-trending linear anomalies, does not portray the same uniformity of linearity displayed by the western third of the domain. The anomalies are generally not as extensive and trend in a greater variety of directions, though the concentration of anomalies is similar. Like its western counterpart the eastern portion north of 64^{O}N latitude coincides almost exclusively with NeoArchean undifferentiated granitoid rocks (Agu) (Skulski et al., 2018). South of latitude 64^{O}N the more detailed geology indicates that much of the stronger RTMF signatures are associated with units of a NeoArchean granulite suite that includes granitic to mafic compositions (ARgrn), NeoArchean tonalite (layered to banded hornblende-biotite orthogneiss) (ARt), and Palaeoproterozoic granite of the Hudson Suite (PHgr) (Tella et al., 2007). Strong, approximately northeast-trending linear RTMF highs along the coastal end of the domain correlate with NeoArchean and/or Palaeproterozoic granulite (anorthosite protolith) (APHIsz) of the Hanbury Island shear zone. Near the southwest corner of the domain a sizable body of Palaeoproterozoic granite and monzogranite of the Hudson Suite (PHg) is partially associated with moderate positive RTMF anomalies.

Domain 30 (Figures 9, 10): Domain 30 lies just east of the Aberdeen sub-basin of the Thelon basin immediately north of Baker Lake, stretching for about 245 km in a general northeast direction, though its path is somewhat irregular. It is defined principally by a pattern of narrow, parallel to sub-parallel, linear to curvilinear derivative magnetic anomalies. These trend northeast near the southwestern extremity of the domain, swing gradually into an eastward direction briefly in the west-central portion of the domain and then swing progressively back to a northeast trend that prevails in the northeast corner of the domain. These linear derivative anomalies are present across the width of the domain.

Most of the domain is characterized by a reasonably strong positive RTMF within which linear elements are everywhere prominent. The RTMF expression is relatively muted along the northern margin of the central part of the domain and portions of the southwestern extremity, but linear features are still discernible.

A series of more or less continuous positive RTMF highs defines a curvilinear belt extending along the spine of the domain from the southwest corner to the northeast corner, though its singularity is difficult to discern in the northeast where it is partially flanked by, and merges with, a contiguous belt of similar magnetic highs to the east. In the southwest, along the north side of Baker Lake, it correlates closely with a belt-like unit of NeoArchean granodiorite of the Snow Island Suite (Agd), an extensive section of which is cataclastic (Skulski et al., 2018). The granodiorite passes northeastward into an extensive, northeast-trending belt-like unit of Palaeoproterozoic granite of the ~1.85 to 1.79 Ga Hudson Suite (PHg) bounded on its northwestern margin by the Chesterfield fault zone (Skulski et al., 2018). Here, in the northeast, the series of magnetic highs is spatially associated with this granite unit, which is flanked to the northwest by either NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg) or NeoArchean mixed gneiss (Amgn), and to the southeast by NeoArchean undifferentiated granitoid rocks (Agu). This southeastern marginal belt of undifferentiated granitoid rocks is characterized by strong linear highs similar to those running along the spine of the domain. The highs and intervening lows presumably reflect the distribution of the different rock-types composing the granitoid unit (Agu) that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite.

The northwestern margin of the domain, where the magnetic field is relatively subdued, yet contains sporadic magnetic highs, is underlain by several different rock units. The main units are NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg), Palaeoproterozoic Hudson Suite granite (PHg), and Palaeoproterozoic mainly metasedimentary rocks (Ps3, Ps½). A small unit of MesoArchean granodiorite to tonalite (Ab) produces a mainly negative expression in the RTMF. A moderately wide and fairly extensive belt-like unit of NeoArchean tonalitic gneiss (Atgn) runs across the central part (north-south sense) of the western half of the domain. The central part of the unit, trending east-west, is characterized by relatively small (spatially) globular to irregularly shaped magnetic highs, but the western and eastern ends, both trending northeastward, are associated with more or less background levels of the magnetic field.

Domain 31 (Figures 9, 10): Domain 31 resembles an irregular rectangle in shape, with an extended protruding northeast corner; its overall orientation is roughly east-northeast. It is truncated to the north and south by domains trending east-west and west-northwest, respectively. Significantly its northern boundary is coincident with, or very close to, the Chesterfield fault zone (Skulski et al., 2018). It is defined by its pattern of derivative anomalies, which contrasts with patterns of adjacent domains either in terms of differences in trend, continuity, concentration or texture of linear magnetic highs forming these patterns, or combinations of these features. Linear magnetic highs generally are not very extensive, though in some cases series of collinear highs indicate the presence of relatively lengthy geological units. Most of these highs trend between roughly north-northwest and northeast, but because they are distributed thinly throughout the domain and because comparatively short linear highs and globular anomalies of varying trend occur laterally between the more extensive linear highs, a strong pattern of linearity is not apparent within the domain. The intensity of the RTMF is variable with relatively weak responses along most of the western margin and the northeast protrusion, though strong linear or globular highs are sporadically present.

The variability in the RTMF and the diverse patterns of linear derivative features is surprising, given that practically the entire domain is underlain by a single unit of NeoArchean undifferentiated granitoid rocks that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite (Agu). It is clear that the geology within this domain is much more complex than the geological map suggests. In the northeast protrusion narrow folded units of Archean-Proterozoic mafic gneiss, amphibolite, metagabbro, peridotite and pyroxenite (APmg) are present (Skulski et al., 2018), and these correlate closely with distinct linear/curvilinear magnetic highs in all magnetic images.

Domain 32 (Figures 9, 10): Domain 32, trending northeast, is defined mainly by its strong pattern of northeast-trending, narrow linear derivative magnetic highs that contrast significantly with complementary patterns in surrounding domains. Some of these linear highs are prominent also in the image of the RTMF, which is quite strong and also an important factor in defining the domain, and with the exception of the field along the eastern margin of Domain 31, stands out above most of the surrounding magnetic field.

Approximately half of the domain is underlain by NeoArchean undifferentiated granitoid rocks that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite (Agu) (Skulski et al., 2018). Several extensive, narrow linear magnetic highs traverse this unit of granitoid rocks, suggesting that they have a superposed structural/compositional fabric having a strong northeast-trending grain. An extensive unit of Archean-Proterozoic mafic gneiss, amphibolite, metagabbro, peridotite and pyroxenite (APmg) (Skulski et al., 2018) runs northeast, more or less along the centre of the domain. Most portions of this unit are associated with a strong RTMF response, but some are traversed by prominent narrow linear magnetic lows or are associated with background values of the magnetic field. Developments of the unit (APmg) in the northeast extremity of Domain 32 correlate with strong highs. Of particular note is a northeast-oriented, elongate oval-shaped band of these mafic-ultramafic rocks (APmg) cored successively inward by a similarly shaped band of NeoArchean mainly metasedimentary rocks belonging to the Committee Bay and Woodburn groups (ACWs) and a solid core of NeoArchean tonalite gneiss (Atgn). The oval-shaped band of mafic-ultramafic rocks (APmg) produces a distinct oval-shaped magnetic high in the derivative images. In this same northeastern area two narrow linear/curvilinear units of Palaeoproterozoic gabbro and diorite sills or dykes (Pga) correlate with strong magnetic highs.

Domain 33 (Figures 9, 10): Domain 33 is an irregularly-shaped domain whose southern half trends generally northeastward and northern half trends northward. These principal areas of the domain link via a very narrow passage between Domains 34 and 35 with a small triangular coastal portion of the domain. Inclusion of this area is based on the relatively subdued RTMF that contrasts markedly with the stronger responses of those two domains. The main portion of Domain 33 is defined principally by the contrasts in orientations of its narrow linear derivative magnetic highs with those along the margins of surrounding domains. In the eastern portion of the southern half linear highs are sub-parallel to parallel, essentially uniformly spaced and generally not very extensive. Typically, they trend between roughly north-northeast and northeast. In the extreme southwestern corner a few short linear highs having similar trends are observed, but between these and those to the east, magnetic highs trend generally approximately eastward. These have a general linear appearance, but they can be irregularly shaped and collectively do not convey an obvious linear pattern.

In the northern half of the domain the concentration of linear derivative magnetic highs is variable and trends are generally between northwest and north. One extremely long and very narrow linear near the southwestern boundary of the northern half correlates with a Mackenzie dyke (PMd) (Skulski et al., 2018), as do two other shorter linears.

The contrast in trends between the northern and southern halves of the domain is mirrored to some extent in the RTMF signature with the northern half being relatively weakly magnetic compared to a generally stronger signature in the southern half. The southern half is dominated by NeoArchean undifferentiated granitoid rocks that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite (Agu). Near the centre of the southern half the granitoid rocks are traversed by a north-northeast-trending belt of amphibolite-, hornblende-biotite- and granitoid-gneisses and migmatite (Amgn). However, other than a segment of this belt being associated with a relatively negative RTMF signature, this belt is essentially invisible in terms of magnetic expression. The magnetic patterns indicate a more complex nature of the unit of granitoid rocks (Agu) than portrayed on the geological map (Skulski et al., 2018), and of its relationship to the gneissic unit (Amgn).

The northern half of the domain is dominated by roughly equal proportions of NeoArchean undifferentiated granitoid rocks that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite (Agu), and NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg). Much smaller areas of some other units, e.g., Archean-Proterozoic granulite complex (APgr), are also present. Apart from a northwest-trending belt of NeoArchean monzogranite and pegmatite (Amg) (Skulski et al., 2018) that mimics the trend of linear derivative magnetic highs in the southwestern portion of this half of the domain and has a relatively suppressed RTMF, there is apparently little correlation between geological units and magnetic signatures.

In the triangular coastal area the more subdued portions of the RTMF correlate with part of an area of NeoArchean undifferentiated granitoid rocks (Agu) and a unit of Archean-Proterozoic mafic gneiss, amphibolite, metagabbro, peridotite and pyroxenite (APmg). Some generally weak positive magnetic highs are associated with a small unit of NeoArchean paragneiss, migmatite, metatexite, and diatexite (Adx) and parts of the undifferentiated granitoid unit (Agu).

Domain 34 (Figures 9, 10): Domain 34 on the coast of Hudson Bay has roughly the shape of a truncated oval that fits quite precisely the mainly mafic Palaeoproterozoic (~1.9 Ga) Daly Bay complex (Fig. 1) (PDc, PDg, PDt, PDga, PDan, PDBm) (Skulski et al., 2018) in which gabbroic rocks feature prominently. This fairly wide complex trends roughly northwestward. Strong narrow, and generally extensive, linear magnetic highs in the derivative images define structural/compositional details, particularly within the unit (PDt) of plagioclase-orthopyroxene rock, plus or minus gabbro that is cut by subconcordant sheets of foliated, orthopyroxene tonalite and makes up the greater part of the complex. These highs are separated by sub-parallel to parallel narrow linear magnetic lows. The highs and lows are prominent also in the RTMF image.

Within most of the domain, northeast of a north-northwest-trending enclave of garnet migmatite (PDBm), trends of linear highs are generally oriented roughly west-northwest, with some indicating large-scale, tight folding within the plagioclase-orthopyroxene unit (PDt) south of the central core of mainly charnockite and garnet leucogranite (PDc).

The plagioclase-orthopyroxene rock unit (PDt) west of the garnet migmatite (PDBm) enclave is associated with linear magnetic highs along only its western half, the eastern half being devoid of such features and correlating with a subdued RTMF. These magnetic characteristics suggest possible compositional differences between the two halves of the unit in this area. It is noteworthy that linear trends west of the garnet migmatite (PDBm) enclave are oriented approximately north-northwest in contrast to the generally roughly west-northwest trends east of the enclave. Also noteworthy is the presence of a prominent, north-northwest-trending, narrow linear RTMF high running along the centre of the northern portion of the garnet migmatite unit (PDBm) and extending well into (>20 km) the plagioclase-orthopyroxene rock unit (PDt) to the north, suggesting a possible gradational relationship between the two units.

Domain 35 (Figures 9, 10): Domain 35 is a broad domain oriented essentially east-west and defined by contrasts in trends of its narrow linear derivative magnetic highs with those in neighbouring domains. Many highs are reasonably extensive, sub-parallel and have a prevailing trend between approximately northeast and east-northeast. Although lateral spacing between the highs is fairly uniform the character of the highs is variable. Some linear highs are moderately extensive and continuous, whereas others may be relatively short and discontinuous, in the sense that small gaps may be present between a series of short highs that collectively outline a linear feature. Sometimes the highs are very short and globular, yet again their distribution indicates the presence of a linear geological unit. Regardless of the nature of individual highs the northeast- to east-northeast-directed grain is always discernible.

The RTMF was not a critical factor in definition of the domain, though there is a noticeable contrast in intensity of the field along large sections of the western and southeastern boundaries, with a strong positive signature within the domain, and a subdued magnetic field characterizing the adjacent Domain 33. The positive signature covers most of the domain with relatively subdued magnetic expressions restricted to the western half of a semi-circular, southward protrusion near the western extremity of the domain, and to the northern marginal area of the domain.

In spite of a prevailing northeast to east-northeast orientation of many linear derivative magnetic highs throughout the domain, mapped geological units having this orientation are rare (Skulski et al., 2018). Exceptions are portions of a unit of NeoArchean paragneiss, migmatite, metatexite, and diatexite (Adx) extending across most of the northern part of the domain that terminates at the coast, and units of NeoArchean mixed gneiss (Amgn) and Archean-Proterozoic granulite grade paragneiss, mafic gneiss, calc-silicate gneiss with mixed gneiss and granite (APgp) in the southern part of the domain (Skulski et al., 2018). Collectively, these units make up quite a small part of the domain. The southern contact of the northern marginal NeoArchean paragneiss unit (Adx) is irregular with several high amplitude, saw-tooth-like serrations directed roughly southwestward to west-southwestward.

Roughly half of the domain is underlain by NeoArchean undifferentiated granitoid rocks (Agu), which enclose large units of NeoArchean monzogranite/granite pegmatite of the ca. 2.61-2.58 Ga Snow Island Suite (Amg), and large Archean-Proterozoic granulite complexes (APgr) (Skulski et al., 2018). Generally, the contacts between the granitoid rocks (Agu) and enclosed units have no significant expression in the magnetic images, though two exceptions are the eastern portion of the southern boundary of the granulite complex (APgr) and southeastern boundary of the northeast-trending unit of mixed gneiss (Amgn) in the southern part of the domain, where distinct linear magnetic highs run parallel to the boundaries. The principal area of undifferentiated granitoid rocks (Agu) runs roughly east-west across the central (north-south sense) part of the domain.

The western and eastern halves of the large granulite complex (APgr) (Skulski et al., 2018) in the southern portion of the domain display differing magnetic patterns and characteristics, indicating differences in structure and possibly composition. The magnetic patterns also define a probable major structural break between the halves that probably is controlled by north-south faulting. The granulite complex in the northern half of the domain trends north-south, and here magnetic signatures signify possible structural and compositional differences between the northern and southern halves.

A large unit of NeoArchean monzogranite/granite pegmatite (Amg) is near-coincident with the semi-circular, southward protrusion of the boundary near the western limit of the domain, though it extends beyond the limits of the domain to the west and south. The magnetic patterns indicate a significant change in the structure, and possibly composition, of the eastern and western portions of the unit. Several parallel, narrow, linear northeast-trending prominent RTMF highs characterize the eastern half, whereas the western half is characterized by a few globular highs and a single west- to west-northwest-trending linear high set in a relatively subdued RTMF.

Domain 36 (Figures 9, 10): Domain 36 is conspicuous by its east-west trend in this part of the Rae craton, expressed by a strong RTMF along its length. The domain extends over a distance of about 135 km with most of its northern boundary being near coincident with the Wager Bay shear zone (Skulski et al., 2018). The western third or so has a general width of about 10 km, compared to about 22 km along the rest of the domain. The RTMF displays a strong linear pattern that is better developed along roughly the northern half of the wider part of the domain. Derivative magnetic images indicate that three principal linear magnetic highs are the main contributors to this signature. They are all quite extensive, narrow, contiguous and parallel. The linearity of pattern is lost near the narrow western extremity of the domain, possibly as a consequence of disruption of the linear sources by cross-faulting. In this area, also, there are two possible instances where adjacent magnetic highs apparently merge forming a pattern similar to that of a nose of a fold. If true, there may be tight folding of geological units elsewhere within the domain.

Although the whole domain is characterized by a prominent RTMF signature, the linearity of contributing individual magnetic highs is essentially absent or very broken in the southern half of the greater part of the domain. The difference in pattern between northern and southern halves is puzzling since the greater part of the domain is underlain by a single geological unit of NeoArchean undifferentiated granitoid rocks (Agu) (Skulski et al., 2018). An exception to the general lack of linear features in the southern part of the domain is observed in the coastal area where a broad Archean-Proterozoic granulite complex (APgr) occupies most of the southern part of the domain over a distance of about 48 km. The difference in linearity within the section of the domain underlain by the granitoid rocks (Agu) may be influenced by proximity to the Wager Bay shear zone in the north.

Domain 37 (Figures 9, 10): Domain 37 lies along strike to the west of Domain 36, but unlike the strong positive RTMF of the latter domain, Domain 37 is characterized by a subdued magnetic field that generally contrasts with stronger signatures along the margins of adjacent domains. This RTMF signature and derivative magnetic patterns characterized by mainly globular highs together define the domain. A few linear, narrow magnetic highs are restricted to the northern margin of the domain along the Wager Bay shear zone and adjacent portion of the collinear Quoich River fault to the west. The eastern end of the northern margin of the domain is essentially coincident with the shear zone and a very short section of the fault. The eastern end of the southern margin is coincident or near-coincident with the Chesterfield fault zone.

The domain pinches dramatically, almost to the point of disappearance, at a distance roughly equal to two-thirds of its length from its eastern end, effectively dividing it into a larger eastern portion oriented east-west, and smaller southwestern portion trending northeastward.

Most of the eastern portion is underlain by NeoArchean mixed gneiss that includes amphibolite gneiss, hornblende-biotite gneiss, granitoid gneiss and migmatite, and is in part derived from sedimentary and volcanic rocks (Amgn) (Skulski et al., 2018). A large unit of metamorphosed Palaeoproterozoic cover sequence that includes gneisses and schists, locally with metabasalt and gabbro (Ps), trends east-northeast near the western end of the eastern portion and contains two small roughly oval bodies of Palaeoproterozoic granite (PHg) of the Hudson Suite. The unit has an imperceptible effect on the RTMF other than possibly producing a subtle negative signature. The two small granite (PHg) bodies likewise do not seem to influence the magnetic field, though one apparently correlates with a very weak magnetic low. Two ribbon-like narrower units of the Palaeoproterozoic cover rocks (Ps) near the eastern end of the domain also seem to correlate with weak negative RTMF anomalies.

The smaller southwestern portion of the domain is also dominated by NeoArchean mixed gneiss (Amgn). A small area of NeoArchean monzogranite/granite pegmatite (Amg) lies along the southeastern margin, a narrow belt of mainly metasedimentary rocks belonging to the Palaeoproterozoic Amer, Chantrey, Woodburn Lake and Penrhyn groups (Ps1/2) extends along the northwestern boundary, and two sizable bodies of Palaeoproterozoic granite of the Hudson Suite (PHg) lie close to the southwest limit of the domain. No noteworthy magnetic signatures are associated closely with any of these geological units, though the most striking magnetic anomaly in the area covers the northwestern half of one of the Hudson Suite granites. The anomaly is a weak to moderately strong, elongate oval-shaped RTMF high. It trends northeastward for about 30 km, passing from the granite into NeoArchean mixed gneiss (Amgn), possibly indicating the presence of granite at shallow depth. Most of the southwestern portion of the domain is characterized by a subdued RTMF, although a few northwest-trending linear highs correlate with mapped Mackenzie dykes (PMd) (Skulski et al., 2018).

Domain 38 (Figures 9, 10): Domain 38 can be viewed as two separate areas within which the principal trends of linear magnetic anomalies differ significantly. However, certain linears are linked and continuous as they gradually change orientation by arcing from one trend to the other, thereby supporting the definition of a single domain. The two areas are separated partially by the west-trending portion of the Quoich River fault that extends westward from the roughly east-west Wager Bay shear zone (Skulski et al., 2018).

The portion of the domain north of these structural breaks, termed northern sector, is a belt-like area north of the shear zone stretching approximately 150 km east-west, and generally some 12 km to 37 km in width. Its eastern end overlaps slightly the east-west Domain 36 to the south. It is defined by its well-developed linear fabric observed in the derivative magnetic images, which display several extensive, narrow linear anomalies and a significant number of shorter counterparts trending generally a few degrees north of west. The linear anomalies feature prominently also in the RTMF, which is strongly positive along most of the belt. The field weakens significantly locally along the northern margin of the domain immediately west of Wager Bay, where it coincides with a segment of a unit of Palaeoproterozoic metamorphosed cover sequences (Ps) and NeoArchean undifferentiated granitoid rocks (Agu) (Skulski et al., 2018). Curiously, these same two rock units along the southern margin are associated with prominent positive anomalies.

The greater part of the domain, the southwestern sector, lies southwest of the northern sector. It is characterized by a linear pattern and trends and intensities of the constituent RTMF highs that are distinct from counterparts in the northern sector. The linear highs trend northeastward in contrast to the approximately east-west trends within the northern sector, although many highs along the eastern margin swing gradually eastward to unite with highs in the northern sector. The intensities of these eastern highs, though not as strong as those in the northern sector, are significant. The spacing between highs in the two sectors is similar and reasonably close. The eastern anomalies fall partly on a unit of NeoArchean undifferentiated granitoid rocks (Agu), and partly on a unit of NeoArchean mixed gneiss (Amgn) (Skulski et al., 2018) along the eastern margin of the domain. The units are separated by the Quoich River fault, here trending roughly northeast. Locally a narrow unit of metamorphosed Palaeoproterozoic cover sequence (Ps) intervening between the two units is associated with a distinct magnetic low. The northeastern part of the Quoich River fault follows closely the edge of a linear RTMF high, but southwestward where the high is less continuous and less distinct it apparently migrates across the high. Mapping the fault on the basis of magnetic signature is, therefore, subject to uncertainty.

In the western part of the western sector the intensities of linear magnetic highs are much weaker and highs are less continuous and sporadically distributed laterally across the area. The magnetic field in general is characterized by a more subdued RTMF signature with levels of the field being near background or slightly relatively negative. This western portion, like the eastern portion, is dominated by NeoArchean undifferentiated granitoid rocks (Agu). The associated much weaker RTMF suggests a probable significant variation in the composition of granitoid rocks within the western sector. Apart from the strong linear highs running northeastward along the eastern boundary of the sector, which are continuous with eastward-trending highs in the northern sector, other northeast-trending highs in the western sector are seemingly truncated at or near the southern boundary of Domain 39 that is characterized by roughly east-southeast-trending linear highs.

The northern sector of Domain 38 coincides mainly with narrow belt-like units or areas of NeoArchean undifferentiated granitoid rocks that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite (Agu), NeoArchean granodiorite of the Snow Island Suite (Agd), and Palaeoproterozoic metamorphosed cover sequences (Ps) (Skulski et al., 2018). The overall trend of all of these units is approximately east-west. A large elongate, roughly oval-shaped unit of Archean-Proterozoic granulite grade paragneiss, mafic gneiss, calc-silicate gneiss, minor mixed gneiss and granite (APgp) is present at the western end of the sector. It would be difficult to differentiate the presence of these different rock units on the basis of the pattern of linear anomalies. In fact, the most extensive linear anomaly traverses the units of NeoArchean undifferentiated granitoid rocks (Agu), Palaeoproterozoic cover sequences (Ps) and Archean-Proterozoic granulite gneisses (APgp), crossing mapped geological boundaries that have no expression in the magnetic images.

Domain 39 (Figures 9, 10): Domain 39 is defined principally by its strong RTMF signature, characterized by sub-parallel linear highs trending roughly east-southeast. It is essentially collinear with the northern sector of Domain 38, whose RTMF expression is very similar. In fact, initially, it was considered that the northern sector of Domain 38 and Domain 39 as presently defined constituted a single domain. However, linear anomalies in the northern sector swing southeastward displaying continuity with linear anomalies in the eastern marginal area of the southwestern sector of Domain 38, whereas linear anomalies farther west in this sector are truncated by linear magnetic highs in Domain 39. These conflicting relationships required re-evaluation of the geological significance of the magnetic patterns.

A subtle break in the linear magnetic patterns, marked by a distinct, narrow magnetic low trending overall roughly E10^{O}N (its path is somewhat tortuous) discernible in the RTMF and magnetic derivative images, was determined at the eastern extremity of Domain 39. The boundary between Domain 39 and the northern sector of Domain 38 is placed along this break. Trends of linears immediately west of the boundary are approximately west-northwest, whereas those to the east in Domain 38 are roughly E5^{O}N to E10^{O}N. Apparently no faults are mapped along the position of the proposed boundary, or along the southern boundary of Domain 39 where linear magnetic anomalies within the southwestern sector of Domain 38 are truncated.

Domain 39 is underlain mainly by NeoArchean undifferentiated granitoid rocks (Agu), covering much of the southwestern half, and a portion of an Archean-Proterozoic granulite complex (APgr) covering most of the northeastern half (Skulski et al., 2018). Smaller bodies of NeoArchean paragneiss, migmatite, metatextite and diatextite (Adx) and NeoArchean tonalite gneiss (Atgn) are present at the western end of the domain. A belt of strong west-northwest-trending, linear RTMF highs characterizes the northern margin of the unit of granitoid rocks (Agu), apparently continuing westward across small bodies of tonalite gneiss (Atgn) and paragneiss (Adx). The geological significance is unclear, but may indicate that these bodies are thin, and that the positive signature reflects underlying NeoArchean undifferentiated granitoid rocks (Agu).

A subtle difference between roughly west-northwest trends in the granitoid unit (Agu) and roughly east-west trends within the granulite gneiss unit (APgr) is noted. The boundary between these two units partially follows closely a series of narrow linear magnetic lows that possibly signify the presence of a fault The boundary may require repositioning to conform to the position of a low along its western end.

Domain 40 (Figures 9, 10): Domain 40 lies east of the Aberdeen sub-basin of the Thelon basin and has an irregular shape with a narrow protuberance extending west-southwest from its northwestern corner. Overall, the trend of the domain is north-northwest over a distance of about 125 km. Contrary to this trend, many of the more extensive and continuous linear magnetic highs within the domain are oriented predominantly east-northeast to northeast. The domain is defined principally on its pattern of derivative anomalies, taking into consideration their orientation and concentration, which differ significantly from those in surrounding domains. Although a reasonably distinct entity as so defined, internally there is a degree of heterogeneity. Along part of the northwest margin, mainly within the protuberance, some linear highs are relatively extensive and oriented east-northeast, whereas similar highs in a portion of the narrow central area of the domain are oriented northeast, and in the southeastern portion of the domain trend approximately east-west. Between these various areas many magnetic highs are globular or oval in shape, or linear but of limited extent, and orientations are variable.

Extremely strong linear magnetic highs characterize the central area of the domain where seemingly more detailed mapping has delineated narrow units of NeoArchean iron formation hosted by a unit of predominantly intermediate volcaniclastic tuff, felsic tuff, reworked tuff, wacke, and rare komatiite belonging to the NeoArchean Committee Bay and Woodburn groups (ACWiv) (Skulski et al., 2018). A single strong linear high just north of the central series also correlates with iron formation, but here hosted by a unit of mafic and minor felsic volcanic rocks (ACWmv) of the aforementioned groups, with some occurrences located within a unit of

Palaeoproterozoic pyroxenite (**P**px) (Skulski et al., 2018). The greater part of the length of the high falls on the pyroxenite unit. A strong linear magnetic high and curvilinear high in the extreme southwestern corner of the domain coincide with mapped iron formation hosted by the same unit of mafic and minor felsic volcanic rocks of the Committee Bay and Woodburn groups (ACWmv). Some narrow bands of iron formation lie close to or along the boundary between this unit and a unit of mainly sedimentary rocks (ACWs) belonging to those groups. In the southeastern area of the domain two strong linear magnetic highs trending mainly east-west, but swinging southward at their western ends, fall on this same mainly sedimentary unit (ACWs). These anomalies doubtlessly indicate the presence of as yet unmapped iron formation.

Linear east-northeast-trending magnetic highs of moderate amplitude along the northwestern margin of the domain fall on a belt of metamorphosed Palaeoproterozoic cover sequence (**P**s) that includes unsubdivided pelitic, marble and metawacke gneisses and schists, and locally metabasalt and gabbro and thin developments of quartzite. In particular the highs are associated with units designated as (**P**s3) and (**P**s4) by Skulski et al. (2018). It is speculated that the highs are related to the mafic igneous rocks in the sequence.

Most of the domain outside areas where linear magnetic highs are prominent is underlain by NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg). Variable changes in magnetic intensity and different textural patterns displayed by the globular, oval and short linear magnetic highs indicate that this granitic area is compositionally and structurally heterogeneous.

Domain 41 (Figures 7, 8): Domain 41is a broad domain having an overall northeast trend that traverses much of the Aberdeen sub-basin. It is defined mainly on the basis of a relatively subdued pattern of derivative magnetic highs that contrasts strongly with patterns of greater concentrations of highs in surrounding domains, with the exceptions of Domains 58 and 69 to the northwest. The boundary with these domains is based on the RTMF image, and drawn along the northwestern edges of two prominent, roughly oval-shaped RTMF highs (**a** and **b**) trending northeast. They are flanked to the northwest by a relatively flat and negative RTMF. Three other prominent roughly oval highs are present within the domain. One traverses the northeast boundary of the Aberdeen sub-basin (**c**), another lies outside the southern margin of the sub-basin within a southwest-directed promontory of the domain (**d**), and the third lies entirely within the sub-basin near the southern margin (**e**).

Most of magnetic high (**a**) lies between the sub-basin and the main Thelon basin falling on a unit of NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg) (Skulski et al., 2018), which doubtless hosts the source of this high. Magnetic high (**b**) falls within the sub-basin so its source is not evident. Pinpointing the source of high (**c**) is problematical even though a large part of the anomaly is located outside the sub-basin. It coincides mainly with metamorphosed Palaeoproterozoic cover sequence rocks (**P**s3, **P**s4). These are mainly metasedimentary, but metabasalt and gabbro is present locally (Skulski et al., 2018). While such igneous rocks could contribute to this magnetic high it is concluded that a more likely source is NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg), because a small unit of these rocks pierces the metasedimentary units right at the boundary of the sub-basin. Given the relationship of magnetic high (**a**) with monzogranite and granite pegmatite (Amg) over a much larger area, such a scenario is considered reasonable. Magnetic high (**d**) falls on a unit of NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg) that covers much of the southwest promontory of the domain, and is probably related to a particular unit within the granodiorite. Like magnetic high (**b**), magnetic high (**e**) falls within the Aberdeen sub-basin, and hence its source is not visible. Magnetic highs (**a**, **b**, **c**, **e**) have been investigated by Tschirhart et al. (2017) who attributed them to granite plutons belonging to the Snow Island Suite.

Other magnetic features of interest are a series of short to moderately long, sub-parallel to parallel, northeast-trending linear magnetic highs within the northwestern half of the Aberdeen sub-basin. These are visible in the RTMF image, but more clearly outlined in the magnetic derivative images. The broadest derivative high, apparently, passes through and coalesces with the derivative counterpart of RTMF high (**b**), northeast of which two linear derivative highs continue northeast and cross the boundary of the sub-basin to traverse northeast-striking metamorphosed mainly sedimentary Palaeoproterozoic cover sequence rocks (Ᵽs4) near the boundary (Skulski et al., 2018). The cover sequences may contain metabasalt and gabbro locally, which are potential candidates for the source of the highs. Tschirhart et al. (2017) speculate that the source of some of these anomalies may be mafic varieties of NeoArchean Snow Island Suite intrusions. They note further that one linear high is directly on strike with exposed magnetic Martell syenite in the Amer Belt, which could also be a potential source. One of the wider magnetic belts has been linked to a southwest-plunging synformal belt within the exposed Amer Belt, defined by magnetic marker units alternating with non-magnetic antiformal quartzite units (Tschirhart et al., 2017).

Domain 42 (Figures 9, 10): Domain 42 is a moderately narrow, gently arcuate domain extending roughly 380 km eastward from near the northern boundary of the Aberdeen sub-basin. It trends east-northeast in the west before gradually swinging eastward towards the centre of the domain, maintaining this direction to the eastern end. Together, Domains 42, 39 and 36 and the northern sector of Domain 38 form an approximately 530 km long, roughly east-west, gently arcuate zone of strong RTMF separating domains to either side that trend generally roughly northeast and/or are characterized to some extent by northeast-trending linear magnetic highs.

Domain 42 is defined principally by its strong RTMF intensity that contrasts markedly with weaker intensities of most contiguous domains, with the exception of Domains 38 and 39 to the south and Domain 57 to the north, boundaries with which are defined by significant contrasts in the patterns of linear derivative magnetic highs. Although Domain 42 has an overall east-west trend, linear magnetic highs having the same trend are not highly concentrated or always extensive. There is, however, a significant number of short to moderately long, linear magnetic highs, along with some more extensive ones, scattered throughout. These are sufficient to give a sense of an overall prevailing east-west grain, even though many other generally short linear highs of different orientation are present in the mosaic.

The gently curved western portion of the northern boundary coincides precisely with the Amer mylonite zone (Skulski et al., 2018). This portion of the boundary is flanked to the south by mainly NeoArchean Snow Island Suite monzogranite and granite pegmatite (Amg) and mixed gneiss (Amgn) in the west, and part of an Archean-Proterozoic granulite complex (AᵽPgr) in the east. However, there is no distinct indication in either the RTMF or derivative magnetic images of the boundaries between these units. The patterns of RTMF and derivative anomalies associated with these geological units are very similar.

In the narrow portion of the domain in the east, where the main rock unit is NeoArchean undifferentiated granitoid rocks (Agu), short to moderately long, linear sub-parallel to parallel highs are present. Two narrow units of NeoArchean mainly metasedimentary rocks of the

Committee Bay and Woodburn groups (ACWs) within the granitoid unit, one trending east-west and the second sub-parallel, are associated with distinct lows in the RTMF image.

Practically the entire eastern end of the domain coincides with a large portion of a unit of Palaeoproterozoic granite of the Hudson Suite (PHg) (Skulski et al., 2018). The RTMF anomalies are reasonably strong, but generally not as strong as those to the west adjacent to the Amer mylonite zone. East-trending, narrow linear derivative magnetic highs are noticeable in the northwestern half of this eastern area, but highs also trend east-northeast, northeast and northwest. Most of these are moderately extensive. In contrast, trends of similar highs in the southeastern half are dominantly northwest, though a series of linear highs and lows, some slightly curvilinear, having different orientations display a distinct circular pattern suggesting the presence of an individual granite pluton within a broader unit of Hudson Suite granite (PHg).

Domain 43 (Figures 11, 12): Domain 43 is one of a series of domains extending northeast from the east-west RTMF "ridge" associated with Domains 42, 39, 38 and 36, terminating at the coast of Committee Bay. It is defined largely on the basis of its stronger concentration of narrow linear derivative magnetic highs that compares with relatively thin concentrations in flanking Domains 44 and 55. Generally, its RTMF intensity is stronger than intensities in the latter domains, though at its southwestern end the overall intensity is generally weaker than within adjoining Domain 42 to the west. These RTMF characteristics considered along with differences in trend of linear derivative magnetic highs, although sometimes subtle, are the basis for defining the boundary with Domain 42.

There is no dominating magnetic pattern within the domain in terms of linear derivative magnetic highs. No obvious, strongly developed trend of anomalies or tightly concentrated groups of anomalies with sub-parallel or parallel trends. There are some reasonably extensive highs scattered within the southwestern half of the domain, south of the Walker Lake shear zone, but most highs are relatively short. The most common trends of the highs are probably east-northeast and north-northeast, which prevail in the southern and northern parts of this portion of the domain, respectively, and impart a sense of linearity in the derivative magnetic patterns. In the northeastern half of the domain linear highs are typically less extensive and their trends are more variable. Hence, there is a lack of linearity in the patterns of derivative magnetic anomalies, and instead a karst-like pattern is presented, particularly well displayed by the magnetic tilt image.

The domain displays a remarkably close correlation with an extensive northeast-trending unit of NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg) (Skulski et al., 2018). A relatively broad, northeast-trending unit of Palaeoproterozoic granite of the Hudson Suite (PHg), extending for about 75 km, falls within the granodiorite unit (Akg) in the central part of the domain. Its presence does not seem to greatly affect the magnetic field, other than slightly to moderately lowering the RTMF intensity.

Domain 44 (Figures 11, 12): Domain 44, extending roughly 165 km northeast, is defined by a relatively subdued RTMF signature that contrasts noticeably with the strong signature of adjacent parallel Domain 43, and with the generally stronger signatures of other contiguous domains. Another defining factor is the generally thin concentration of derivative magnetic highs, contrasting with stronger concentrations in all surrounding domains. Although thinly concentrated, the trends of linear narrow linear highs are more ordered in Domain 44 than in neighbouring domains, with a distinct northeast-southwest trend being observed throughout most

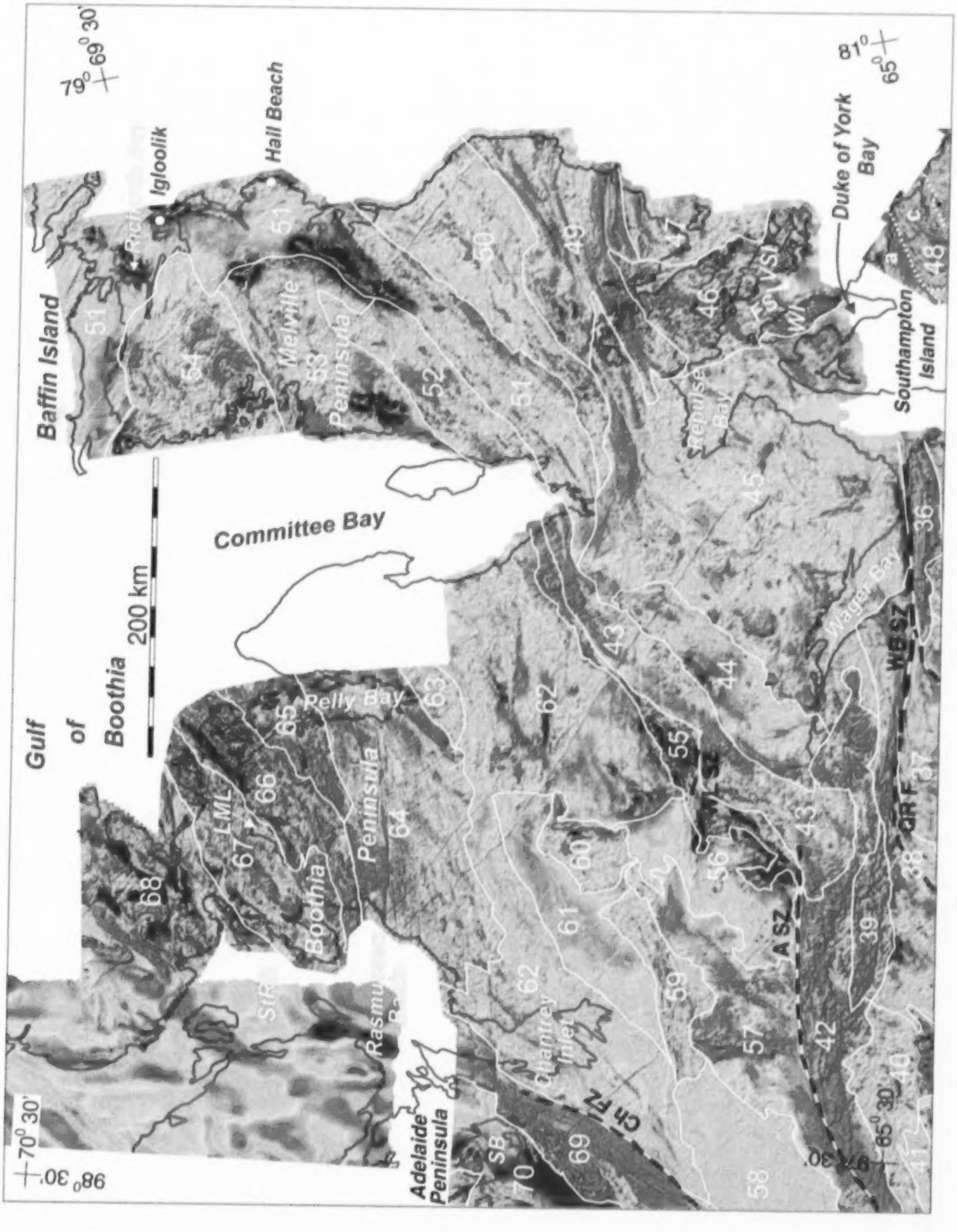
Baffin Island
Igloolik
Hall Beach
Gulf
of
Boothia
Committee Bay
200 km
Melville
Peninsula
Pelly Bay
Boothia
Peninsula
Repulse Bay
Wager Bay
Duke of York Bay
Southampton Island
Chantrey Inlet
Adelaide Peninsula
StRB
LML
VSI
WI
A SZ
WB SZ
QR F
Ch FZ
WL SZ
SB
a
c
79° 69° 30'
81° 65°
98° 30' 70° 30'
87° 30' 65° 30'
51
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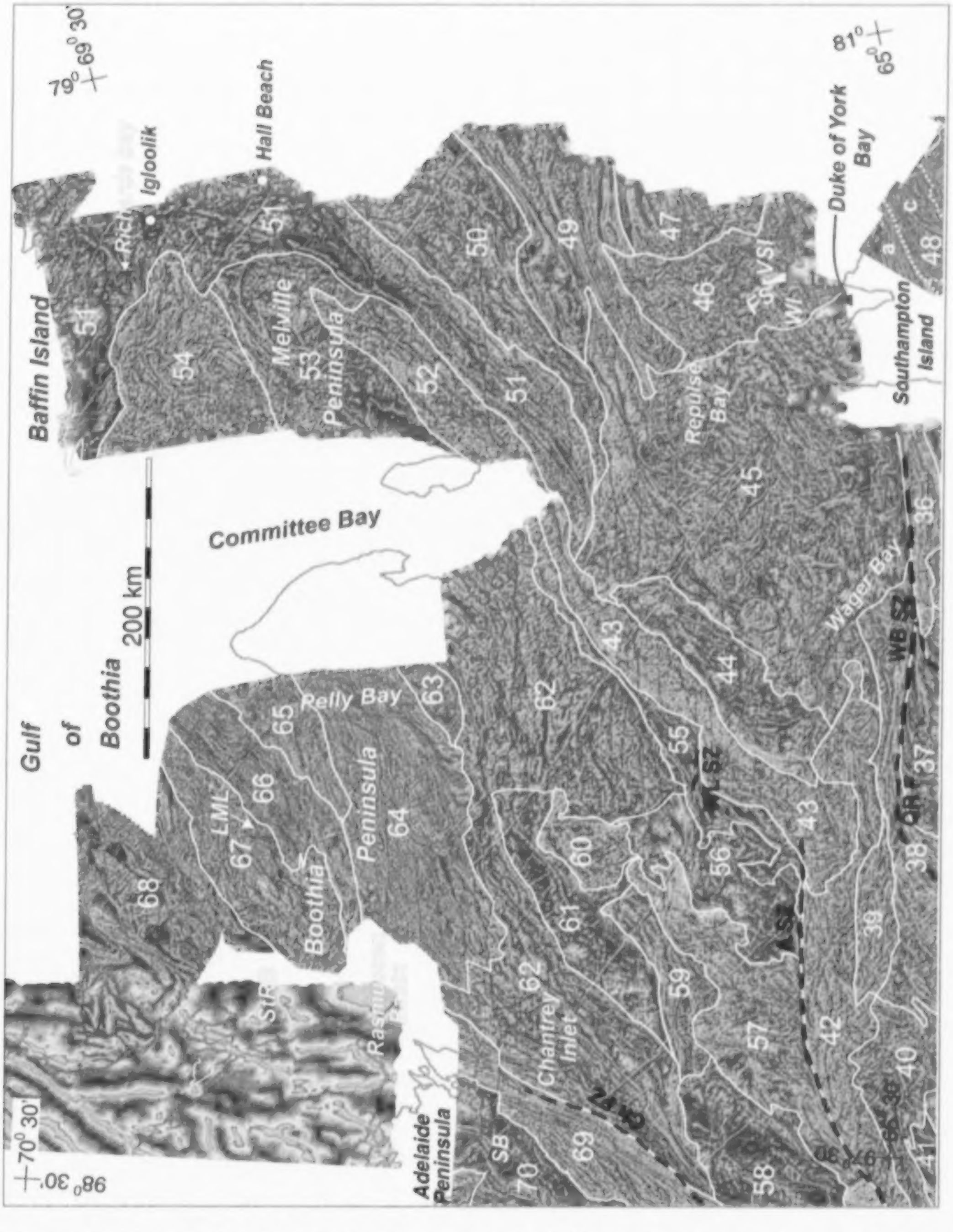
Figure 11: Map of residual total magnetic field for northeastern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: A SZ, Amer shear zone; Ch FZ, Chantrey fault zone; QR F, Quoich River fault; WB SZ, Wager Bay shear zone; WL SZ, Walker Lake shear zone. Geographical features: FS, Frozen Strait; StRB, St. Roch Basin; VSI, Vansittart Island; WI, White Island.


Gulf of Boothia
Committee Bay
200 km
Baffin Island
Igloolik
Hall Beach
Melville Peninsula
Repulse Bay
Duke of York Bay
Southampton Island
VSI
WI
Wager Bay
WB SZ
QR F
WL SZ
A SZ
Pelly Bay
Boothia Peninsula
LML
StRB
Rasmussen Basin
Chantrey Inlet
Ch FZ
Adelaide Peninsula
SB
79° 69° 30'
81° 65°
70° 30'
98° 30'
97° 30'
66° 30'
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a
c

Figure 12: Map of tilt of residual total magnetic field for northeastern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: A SZ, Amer shear zone; Ch FZ, Chantrey fault zone; QR F, Quoich River fault; WB SZ, Wager Bay shear zone; WL SZ, Walker Lake shear zone. Geographical features: FS, Frozen Strait; StRB, St. Roch Basin; VSI, Vansittart Island; WI, White Island.

of the domain. In the southwestern third of the domain some linears swing into, or are oriented in, a more south-southwest direction, and some trend southward or south-southeastward.

Most of the domain is underlain by NeoArchean mixed gneiss (Amgn) extending along roughly three quarters of the length of the domain, and there are large units also of NeoArchean undifferentiated granitoid rocks (Agu), NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx), NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg) and NeoArchean undifferentiated supracrustal rocks (As). Most of these units, and/or some of their contacts, trend generally northeast. The greater parts of all of these units correlate with the subdued expression of the RTMF, and mutual contacts apparently have little to no expression in the magnetic images. A narrow, arcuate unit of the undifferentiated supracrustal rocks (As) oriented roughly north-south near the southwestern end of the domain does display a more or less continuous, distinct narrow magnetic high following the trend of the unit. Its strength is variable in the RTMF image, but its continuity along the length of the unit is revealed in the magnetic derivative images. The supracrustal rocks contain iron formation, and even though the high is not particularly strong it is believed to relate to iron formation.

Five bodies of Palaeoproterozoic granite of the Hudson Suite (PHg) are present within the domain (Skulski et al., 2018), four of them in the northeastern half. These are small to moderate in size, with maximum dimensions ranging from about 6.6 km to 33.9 km. The two smallest ones, in the northeastern half, are roughly circular and associated with a prominent positive RTMF response. One of two larger bodies in the northeast having an overall northeast trend, but irregular in shape, also produces a strong positive signature. The other, roughly elongate oval in shape and trending north-northeast produces no apparent magnetic response, its associated field resembling background. An area of granite (PHg) in the southwest corner of the domain, part of a much larger body extending northward from the eastern end of Domain 42, produces a noticeable positive signature. Skulski et al. (2018) note that these granites may include disseminated magnetite.

Two other noteworthy magnetic highs are a strong, very narrow linear high corresponding with a unit of NeoArchean tonalite and quartz diorite (Ato) along the northwestern margin of the central region of the domain, and a broader and stronger linear high along the northwestern margin in the southwestern part of the domain, where it corresponds to a marginal section of the large unit of NeoArchean Snow Island Suite K-feldspar porphyritic granodiorite ± hornblende ± magnetite (Akg) that dominates Domain 43 to the northwest. Most of the adjacent portion of the unit within Domain 43, while displaying a significant positive RTMF response, is not as strongly magnetic as the marginal zone of the unit within Domain 44.

Domain 45 (Figures 11, 12): Domain 45 is a large domain along the eastern margin of the Rae craton having maximum north-south and east-west dimensions attaining over 210 km and 260 km, respectively. Overall, it is crudely square in shape, but the western boundary protrudes significantly westward forming a roughly triangular area, and the northeast corner takes the form of a narrow protrusion trending east-northeast. Domain 45 is surrounded by 10 other domains, boundaries with which have been defined using various criteria, such as contrast in RTMF intensity, contrast in texture and pattern of RTMF and derivative magnetic anomalies and orientation of narrow linear anomalies. Generally, these criteria have permitted reasonably clear definition of boundary positions, though with some uncertainty in places.

Internally the domain is characterized by heterogeneity of RTMF expression and a general diversity of orientations of linear magnetic highs. Irregular areas of noticeable magnetic highs are distributed throughout the area within a background level of magnetic field that covers much of the central region of the domain. It is within this central area, notwithstanding a diversity in trends of linear anomalies, the RTMF map displays a perceptible northeast-oriented linear textural grain defined by narrow linear magnetic highs standing out from the background field.

Noteworthy larger areas of magnetic high are a broad, east-west belt immediately north of the northwest end of Wager Bay, and a prominent east-west belt along the northern margin that extends into the protrusion in the northeast corner. Two small areas of noticeably stronger positive response are present at the west end of the former belt, near the boundary of the domain, and a large circular magnetic high (diameter ~20 km) lies on the northern flank of the belt. The two smaller anomalies fall on opposite ends of a unit of Palaeoproterozoic granite of the Hudson Suite (PHg) (Skulski et al., 2018). The rest of the unit is associated with an overall weaker positive response distributed as a series of small globular or short linear highs. The large circular high displays an outer ring in its associated pattern of linear/curvilinear derivative magnetic highs. It correlates closely with a circular unit of Hudson Suite Palaeoproterozoic granite (PHg). The largest (spatially) positive RTMF anomaly within the belt of magnetic high along the northern boundary coincides very closely with a unit of pegmatite recognized as a syn-collisional intrusion (Corrigan et al., 2013), apparently associated with late Palaeoproterozoic evolved granite intrusions (Erdmann et al., 2013) having ages between 1816 and 1798 Ma (David Corrigan, Personal Communication, 2017). An adjacent smaller unit of the pegmatite is also associated with an area of relatively positive RTMF within which a narrow, linear magnetic high extending roughly 38 km eastward is particularly noticeable. Approximately half the length of this anomaly extends beyond the border of the pegmatite unit, indicating its possible presence within terrain mapped as Archean migmatitic intermediate to felsic orthogneiss (Corrigan et al., 2013). These pegmatite units are identified as Palaeoproterozoic granite of the Hudson Suite (PHg) by Skulski et al. (2018).

Geologically, the domain is dominated mainly by NeoArchean undifferentiated granitoid rocks (Agu) and NeoArchean mixed gneiss (Amgn), though sizable bodies of Palaeoproterozoic granite of the Hudson Suite (PHg) (Skulski et al., 2018) punctuate most of the western margin, part of the northern margin and the area of the northeastern shore of Wager Bay. A fairly large unit of NeoArchean tonalite gneiss (Atgn) is present in the northwestern apex of the domain. The noted perceptible northeast-oriented linear textural grain in the internal central portion of the domain is probably a reflection of lithological banding and structural trends within the various granitoid-gneiss rock-types.

Several irregular areas of RTMF high having a karst-like texture display a good correlation with units of Hudson Suite granite (PHg) within the western margin of the domain. This close correlation and the observation that the broad east-west belt of positive magnetic signature in the western protrusion of the domain is significantly more extensive than mapped units of Hudson Suite granite (PHg) suggest that granitic rocks may be more extensive in this area than geological mapping indicates, and/or are present at shallow depth below mapped units of NeoArchean undifferentiated granitoid rocks (Agu) and NeoArchean mixed gneiss (Amgn).

A southeastern portion of the domain coincides with Repulse Bay and northern tip of Southampton Island that is underlain by Palaeozoic carbonate and siliciclastic rocks (Skulski et al., 2018). In this area, because of water and sedimentary cover, the magnetic signature is attenuated and relatively smoothed. The attenuated field contrasts strongly with the field over Precambrian rocks on the shore and on nearby White Island. The portion of the eastern boundary of Domain 45 running through Repulse Bay and near the west coast of White Island may not therefore truly represent a magnetic domain boundary related to Precambrian bedrock. Rather it marks a significant change in thickness of water and/or Palaeozoic sedimentary cover. The observation that trends of narrow, linear magnetic highs adjacent to and crossing the portion of the boundary near Southampton and White islands, and even extending farther northeast to Vansittart Island, are consistently northeastward supports a case for a single domain. It may, therefore, be more appropriate to link Domain 45 and Domain 46 as a single domain.

Domain 46 (Figures 11, 12): Domain 46 is roughly rectangular in shape with its long axis oriented approximately N15^{O}W. It covers part of the southern coastal area of Melville Peninsula and extends offshore to embrace White and Vansittart islands. It is defined by the karst-like appearance of its positive RTMF signature, which is ubiquitous throughout the domain. This characteristic is in stark contrast with the smoother texture of the positive magnetic signature within the adjacent portion of Domain 45 to the west, previously attributed to the presence of Palaeozoic carbonate and siliciclastic rocks (Skulski et al., 2018) and oceanic waters. It is differentiated from Domain 49 to the north and northeast by a contrast in trends of narrow linear derivative magnetic highs and texture of derivative anomalies, and from Domain 47 to the east principally by a difference in the texture and intensity of first vertical derivative anomalies.

On the mainland east of Repulse Bay Domain 46 correlates almost entirely with a unit of Archean charnockite and other orthopyroxene-bearing plutonic rocks, and a narrow coastal strip of migmatitic intermediate to felsic orthogneiss (Corrigan et al., 2013), the latter unit identified as mainly NeoArchean gneissic to foliated monzogranite (Aot) by Skulski et al. (2018). The tilt image displays generally very short linear or elongate globular highs of variable orientation in harmony with the karst-like appearance of the RTMF, though sporadic, slightly longer linear highs are oriented northeast. Over Repulse Bay and White and Vansittart islands the textural pattern of tilt anomalies having variable trends is similar, although a northeast-oriented grain, albeit weak in places, is perceptible. On White Island the prevailing rock-type is NeoArchean mainly gneissic to foliated monzogranite (Aot), and there are small units of NeoArchean granulite complex that include a variety of meta-plutonic rocks (Agr) (Skulski et al., 2018). The main unit of monzogranite (Aot) runs the length of the north-northwest-trending island, so a cross-cutting, roughly east-northeast trend of magnetic anomalies is surprising. Vansittart Island is composed of roughly equal proportions of NeoArchean granulite complex (Agr) and granulite facies mixed gneisses (Amgo). In places, these units alternate to form broad bands and contacts that trend variably between east-northeast to northeast. A few linear magnetic anomalies crossing Vansittart Island have similar trends indicating some degree of compatibility with the geology.

Domain 47 (Figures 11, 12): Domain 47 is a very small domain at the southeastern tip of the Melville Peninsula that covers roughly equal areas of land and offshore waters. It is differentiated from Domain 49 to the north by its significantly weaker pattern of roughly east-west, narrow linear RTMF highs, and from Domain 46 to the west by a noticeable difference in the texture and intensity of first vertical derivative anomalies. The eastward-trending northern boundary of the domain is positioned along a boundary between belt-like units of Archean mainly felsic migmatitic orthogneiss that includes tectonically dismembered metagabbro dykes to the north within Domain 49, and of Palaeoproterozoic ferruginous pelite, psammopelite and marble within Domain 47 (Corrigan et al., 2013) that is partially contiguous with, and sub-parallel to, another belt-like unit of migmatitic orthogneiss on its southern flank. All of these units strike east-west. There are strong correlations between magnetic anomalies and these geological units. The two units of Archean mainly felsic migmatitic orthogneiss with dismembered dykes are associated with strong positive linear RTMF anomalies, whereas the Palaeoproterozoic ferruginous unit correlates with a distinct linear negative anomaly.

The map of Skulski et al. (2018) differs, displaying a narrow belt of Palaeoproterozoic metamorphosed cover sequence composed mainly of metasedimentary rocks (Ps) immediately north of the northern boundary positionally occupying the southern margin of the broader unit of Archean mainly felsic migmatitic orthogneiss (Corrigan et al., 2013). The narrow metasedimentary unit (Ps) is associated with a prominent linear magnetic high. Immediately south of the boundary Skulski et al. (2018) show a narrow band of a metaplutonic NeoArchean granulite complex (Agr), bordered in succession to the south by east-west-trending belts of NeoArchean foliated to gneissic orthopyroxene-clinopyroxene tonalite and diorite (Aotn), NeoArchean granulite complex (Agr) and NeoArchean tonalite and diorite (Aotn), the latter flanked to the south by a wider area of the granulite complex (Agr). Curiously, the two belts of NeoArchean tonalite and diorite (Aotn) fall within the limits of different geological units identified by Corrigan et al. (2013): the unit of Palaeoproterozoic ferruginous pelite, psammopelite and marble immediately south of the domain boundary, and the partially contiguous unit of Archean mainly felsic migmatitic orthogneiss to the south.

According to Corrigan et al. (2013), the domain south of the northern part dominated by east-west-trending geological units is formed by Archean units of felsic-intermediate plutons, orthogneiss and migmatite, and of charnockite and other orthopyroxene-bearing plutonic rocks, whereas the map of Skulski et al. (2018) shows NeoArchean units of a granulite complex (Agr), tonalite and granite (Aot), granulite facies mixed gneiss (Amgo) and foliated to gneissic ± hornblende-biotite granodiorite (Ahg). The magnetic derivative images in this southern coastal area indicate some areas with a weak linear pattern of narrow anomalies oriented roughly E15^{O}N. Most of these anomalies are "discontinuous" in the sense that a series of collinear, globular to elongate globular highs defines a single linear anomaly. And in other areas any linear pattern of anomalies is difficult to discern, and patterns of linear derivative anomalies are more chaotic.

Domain 48 (Figures 9, 10): Domain 48 corresponds with the area of Precambrian rocks on Southampton Island, included in this report because of the proximity of the island to the mainland. A geological map of the Precambrian rocks accompanied by descriptive notes has been published by Sanborne-Barrie et al. (2014b). Even though Domain 48 is very close to Domain 46 on the mainland, the magnetic signatures are quite different, and there is no magnetic evidence for linking the two domains. The RTMF signature of Domain 48 is characterized everywhere by prominent magnetic highs that are generally narrow and linear or curvilinear, and fairly tightly concentrated. Many are very extensive and/or sub-parallel, but trends vary considerably, which is the rationale for subdividing the domain into 4 subdomains, though one is differentiated based on a lack of linear anomalies.

Subdomain **a** is very small and lies just southeast of Duke of York Bay at the apex of the domain. It is characterized by a series of closely spaced, narrow, strong linear magnetic highs trending roughly E15^{O}N across a unit of Archean typically strongly foliated to gneissic, granodiorite-tonalite±monzogranite (Agd) dated at ca. 2750 Ma (Sanborne-Barrie et al., 2014b). The eastern half of the subdomain's southern boundary follows closely the boundary between the latter geological unit (Agd) and a unit of Archean tonalite±granodiorite±quartz diorite (Atg) within Subdomain **c**, though unit (Agd) crosses the western half of the southern boundary into Subdomain **c**.

Subdomain **b** covers the western marginal area of the domain and is defined essentially on the basis of a comparative lack of linear magnetic highs. Sporadic areas of positive RTMF occur along the length of the subdomain, but linear elements are generally weak. The derivative maps do bring some narrow linear highs into focus, but these have variable trends. Some are aligned north-south along the trend of the subdomain, whereas others trend at various orientations across the subdomain. Some linear highs are represented by a series of disconnected globular to elongate globular highs arranged in collinear fashion. The eastern boundary of Subdomain **b** coincides almost exactly with the boundary between Precambrian rocks to the east and Ordovician-Silurian rocks (OS) to the west.

Subdomain **c** is distinguished by its strong linear pattern of narrow, commonly extensive linear/curvilinear magnetic highs visible in the RTMF and magnetic derivative images. The subdomain has the shape of a truncated crescent, narrow in the south and widening northward before swinging northeast and then east-northeast to the coast of Southampton Island, where its eastern arm is abruptly truncated. The subdomain can be described in terms of a southern and eastern arm. The trends of linear/curvilinear highs mimic the trend of the subdomain. The eastern arm of the subdomain is dominated by Archean tonalite±granodiorite±quartz diorite (Atg) that includes narrow belts of Archean monzogranite (Agg), the two principal belts swinging into the southern arm where they flank a central unit of Archean tonalite-granodiorite±monzogranite (Atn). These units together with a western marginal belt of Archean typically strongly foliated to gneissic, granodiorite-tonalite±monzogranite (Agd), some of the same unit in the southern tip of the subdomain, and a narrow centrally located unit of Proterozoic or Archean monzogranite (PAgg) form most of the southern arm. Noticeable within the southern arm is a distinct narrow, north-trending RTMF low that correlates with a unit of Proterozoic or Archean psammite-quartzite±semipelite (PAps), a correlation noted by Sanborne-Barrie et al., (2014b).

Subdomain **d** covering the southeastern corner of the domain is the largest subdomain, representing about half of Domain 48. It is characterized by narrow linear magnetic highs that trend generally northwest, principally in the southwestern half of the subdomain. Some roughly northeast to north-northeast trends are noticeable along the northern part of the southeastern boundary of the subdomain near the coast, and linear highs with other trends are observed elsewhere, though typically not in large groups. The variety of trends sets Subdomain **d** clearly apart from the broad belt of sub-parallel trends defining Subdomain **c**. Yet in spite of the contrast in magnetic trends, doubtless related to structural trends, the subdomain is dominated by the same two principal geological units as Subdomain **c**, namely units of Archean typically strongly foliated to gneissic, granodiorite-tonalite±monzogranite (Agd), and Archean tonalite±granodiorite±quartz diorite (Atg). In fact the boundary between the two subdomains runs well within the interiors of units of these rock-types with no indication of a related structure, such as a fault that would be expected from the contrast in magnetic trends at the boundary. Curiously, however, a series of several narrow (maximum width roughly 200 m to 1000 m) geological units trending characteristically roughly northwest and distributed across a width of about 10 km terminate northwestward at the northern east-northeast-trending section of the boundary. These units are quite short, the maximum length being about 5.4 km. They are all Archean and located within a unit of the Archean tonalite±granodiorite±quartz diorite (Atg) and are formed of anorthosite±gabbroic anorthosite (Aan), ultramafic plutonic rocks (Aum), gabbro±diorite±leucodiorite (Agb), metasedimentary rocks and associated peraluminous granite (Asp) and monzogranite (Agg). The termination of so many units is considered strong evidence for the presence of a fault in this location at least.

In addition to the two principal units covering the subdomain, the Archean strongly foliated to gneissic, granodiorite-tonalite±monzogranite (Agd), and tonalite±granodiorite±quartz diorite (Atg) units, two large units of Palaeoproterozoic monzogranite-granodiorite (Pmz) are present near the western margin of the subdomain. One extends north-northwestward from the coast and the other lies further inland in the northern half of the subdomain. The coastal example attains a width of about 10 km, extends for about 35 km and is associated with one of the strongest RTMF signatures in the subdomain that comprises several narrow, sub-parallel linear magnetic highs trending north-northwest. This group of highs continues offshore to the south swinging into a southeast direction and tracking the extension of this unit (Pmz). The smaller northern example is also associated with a distinct positive RTMF signature that also includes narrow, linear highs.

The sources of northeast to north-northeast-trending highs along the southeastern boundary near the coast are difficult to assess, principally because of limited mapping influenced by widespread Quaternary unconsolidated cover in the form of mainly glacial till and fluvial deposits. Some highs apparently cut across a narrow unit of northwest-trending Archean monzogranite (Agg) without noticeable effect at boundaries to either side with Archean granodiorite-tonalite±monzogranite (Agd), pointing to sources within the latter unit.

Domain 49 (Figures 11, 12): Domain 49 extends roughly 200 km approximately west-southwestward from the east coast across the widest part of Melville Peninsula, bifurcating near its west-southwestern end. It is clearly distinguished from all adjacent domains by its well developed linear fabric of narrow linear magnetic highs observed in the RTMF and derivative magnetic images.

The southern arm of the bifurcation and its projection east-northeast along strike coincides in greater part with a broad belt of Archean migmatitic intermediate to felsic orthogneiss, with a smaller area falling on the northern margin of a large unit of Archean charnockite and other pyroxene-bearing plutonic rocks (Corrigan et al., 2013). The positioning of the southern boundary of Domain 49 cutting through the charnockite unit was based mainly on differences in trends of short to moderately long linear magnetic highs within the domain and adjacent Domain 46 to the south. The texture of the RTMF within both domains is similar, and in the absence of a contrast in trends it is likely that the boundary between domains would have followed closely the northern boundary of the charnockite body. The boundary is positioned on the aforementioned evidence, however, and it is apparent that it marks a change in the internal structural fabric of the charnockite body.

The shorter northern arm of the bifurcation and its roughly east-northeast projection to the coast coincides with two principal units, Archean felsic to intermediate plutons, orthogneiss and migmatite and Palaeoproterozoic quartzite, marble, calc-silicate gneiss, metapelite and sulphidic pelite of the Lower Penrhyn Group (Corrigan et al., 2013). Over most of this area, east of the point of bifurcation, the two units form long sub-parallel belts. Almost invariably the Archean unit is associated with distinct, narrow linear magnetic highs, whereas the Palaeoproterozoic metasedimentary unit is marked by some linear magnetic lows and some areas of relatively subdued, yet positive magnetic field. Metasedimentary units, or portions thereof, having a positive expression are believed to be thin and their magnetic signatures probably reflect the underlying Archean basement.

Within the western, bulbous portion of the northern arm of the bifurcation, the belts of Archean felsic to intermediate plutons, orthogneiss and migmatite and Palaeoproterozoic metasedimentary rocks alternate, as further east, but are less extensive. The magnetic signatures of these units are similar to those described within the east-northeastern projection.

Domain 50 (Figures 11, 12): Domain 50 runs roughly W30^{O}S across the southern part of the Melville Peninsula tapering gradually from the east coast, where it is about 80 km wide, to its point of termination near the south end of Committee Bay. For about 75 km from its western limit the domain is oriented east-west. The domain overall is characterized by a positive RTMF signature, albeit weak to moderately strong, with values generally <200 nT. There is a series of sub-parallel, short narrow magnetic highs in the southwestern constricted portion of the domain where peak values along the axes commonly attain several hundred nT with many in the range of roughly 1000 nT – 2600 nT. A similar picture applies to a single interrupted chain of similar highs running close to the centre of the wider northeastern portion of the domain with the highest values in this case ranging from about 1000 nT – 4500 nT.

The northern boundary of Domain 50 is defined primarily by a change from the overall weak to moderate RTMF within, to a belt of strong, linear RTMF anomalies running along the margin of Domain 51. The southern boundary is positioned where the anomalously subdued field along the margin gives way to a generally more intense field within Domain 49. Domain 50 is also identified by its lack of a pervasive, well defined linear magnetic fabric, compared to fabrics in adjacent domains.

Geologically the domain is similar to Domain 49 with units of Archean felsic to intermediate plutons, orthogneiss and migmatite and Palaeoproterozoic quartzite, marble, calc-silicate gneiss, metapelite and sulphidic pelite of the Lower Penrhyn Group, together, covering most of the domain (Corrigan et al., 2013). Unlike the picture for Domain 49, differences between the RTMF expressions of these two units are not so striking. Generally a weak to moderate RTMF characterizes both units, though some small areas of relatively negative field are associated with the metasedimentary rocks of the Lower Penrhyn Group. A large unit of the Upper Penrhyn Group comprising mainly metasiltstone and psammopelite near the coast is accompanied by a magnetic field similar to that over the Lower Penrhyn Group, generally moderately positive, but with a relatively negative expression along its eastern margin. The positive signatures dominating the Penrhyn Group are interpreted to indicate relatively thin developments with signatures related to underlying basement. A sizable unit of an Early Proterozoic bimodal leucogabbro-anorthosite and granitic plutonic suite is present near the coast, striking northeast between units of the Penrhyn Group. Its associated RTMF is more uniformly positive and marginally stronger than the adjacent RTMF signatures over the metasedimentary Lower Penrhyn Group and Upper Penrhyn Group to the north and south, respectively.

The very strong, narrow linear magnetic highs described in the southwestern constricted portion of the domain correlate closely with narrow units of Archean supracrustal rocks that include felsic, mafic, and ultramafic volcanic rocks, metapelite, oxide-facies banded iron formation and ferruginous psammite. These units are surrounded mainly by Archean felsic to intermediate plutons, orthogneiss and migmatite. The highs with their large peak values are doubtless related to iron formation. Narrow units of these Archean supracrustal rocks are observed striking northeast within the unit of Early Proterozoic bimodal leucogabbro-anorthosite and granitic plutonic suite near the coast, correlating with the strong, narrow linear magnetic highs noted to run near the centre of the widest part of the domain. These strong anomalies again indicate the presence of iron formation.

A short chain of juxtaposed globular highs, collectively forming a short curvilinear magnetic high between the sub-parallel highs in the southwest and the highs within the bimodal leucogabbro-anorthosite and granitic plutonic suite to the northeast, correlate closely with a small unit of Early Palaeoproterozoic diorite, quartz diorite and granite enclosed by Archean felsic to intermediate plutons, orthogneiss and migmatite. Peak values are not as strong as observed over the units of Archean supracrustal rocks, but a single peak of 1425 nT suggests that this Early Palaeoproterozoic plutonic unit may instead be another unit of Archean supracrustal rocks containing iron formation or is accompanied by such rocks. Small to very small syncollisional pegmatite intrusions scattered throughout the domain seemingly have little to no expression in the magnetic field.

Domain 51 (Figures 11, 12): Domain 51 is an unusual domain from the viewpoint of the contrasting RTMF signatures within it. A belt-like southwestern section of the domain extends from the south end of Committee Bay northeastward towards the east coast, close to which it swings northward to continue to the northeast tip of Melville Peninsula where it turns abruptly westward along the north shore of the peninsula. Most of the northeast-trending section is characterized by a moderately strong RTMF signature that includes distinct superposed narrow, sub-parallel magnetic highs of varying extent. The overall signature is similar to that of adjacent Domain 52 to the northwest, though Domain 51 displays a somewhat stronger linearity in magnetic derivative images. As this linear section swings northward along the eastern coastal area the magnetic field becomes relatively weak, smooth and unperturbed at a level that might be considered background. This picture maintains as the section changes direction again to swing west-northwestward to run along the northern coast of the peninsula.

In spite of this big contrast in magnetic signature, all areas have been incorporated within one domain based on the extension into the coastal area of a very strong, narrow linear RTMF high running along the northwestern boundary of the domain adjacent to the northeast end of Domain 52 and a proximal portion of Domain 53. This high extends for about 30 km and is associated with peak values of several thousand nT that attain >14000 nT. The high apparently continues northeast as two separate branches, each roughly 60 km long. One branch follows the boundary with Domain 53, while the second trends approximately east-northeast along the central part of Domain 51. High peak values of several thousand nT are associated with both branches, though those along the former branch are generally larger.

The branches end near the coast in an area where the magnetic field between, and north of them, is relatively smooth, though locally generally weak globular or short linear highs are present. There are no prominent features in the RTMF map in this region suggestive of a domain boundary. In the derivative images, however, three short linear highs lie between, and are sub-parallel to, the two principal linear branches, all of which are seemingly truncated along a line trending N35^{O}W over a distance of about 30 km. Possibly this feature could warrant designation as a domain boundary, separating the lineated and smoothed portions, but this has not been applied in this report. If not signifying a domain boundary, it possibly suggests the presence of a fault.

The north-trending portion of the boundary between Domains 51 and 53, separating the strong marginal linear high in Domain 51 from a similar north-trending linear high along the margin of Domain 53, is cause for some concern. The boundary was positioned on the basis of a contrast in RTMF across it, smooth to the east and perturbed to the west, and strong differences in the texture of magnetic derivative images. Consternation arises because the linear high within Domain 53 is associated with the same geological unit as the marginal linear high within Domain 51. The unit is one of Archean supracrustal rocks that include komatiite, basalt, rhyolite, dacite, andesite, banded iron formation and siliciclastic metasedimentary rocks (Corrigan et al., 2013), mapped as continuous from one magnetic domain to the other. Given this continuity it is debatable whether a domain boundary should cut across this singular geological source. But, considering that magnetic domains reflect elements defined principally on the basis of structural fabric, it is considered acceptable for the same geological unit to be present in adjacent structural elements.

Most of the southwestern arm of the domain correlates with an Archean unit of felsic to intermediate plutons, orthogneiss and migmatite (Corrigan et al., 2013), which is mainly responsible for the linear magnetic fabric in this part of the domain. Skulski et al. (2018) portray most of the same area as a unit of NeoArchean generally foliated to gneissic granitoid rocks that can include diorite, monzodiorite, tonalite, granodiorite and monzogranite (Agu). A belt of generally more intense and concentrated magnetic anomalies running along a portion of the southeastern margin of the domain coincides with an elongate unit of Early Palaeoproterozoic diorite, quartz-diorite and minor granite (Corrigan et al., 2013). The intense linear RTMF high following the western/northwestern margin of the domain, curving around the boundaries with Domains 52 and 53, is clearly associated with a band of Archean komatiite, basalt, rhyolite, dacite, andesite, banded iron formation and siliciclastic metasedimentary rocks. Curiously, the intense linear high that apparently branches from the latter high to extend along the centre of the domain correlates precisely with an east-northeast-trending narrow unit of Archean ultramafic rocks that include pyroxenite and serpentinite flows and/or sills. These ultramafic rocks are partially hosted by a unit of Archean felsic to intermediate plutons, orthogneiss and migmatite, and partly by a narrow unit of Archean mainly siliciclastic supracrustal rocks with minor mafic to felsic volcanic rocks (Corrigan et al., 2013). The two branches terminate near the coast extending partially across Phanerozoic sedimentary cover (Ordovician-Silurian) (Corrigan et al., 2013), pointing to their presence in buried Precambrian basement.

The eastern and northern coastal portion of the domain is underlain almost exclusively by Phanerozoic sedimentary cover characterized mainly by the aforementioned subdued and generally featureless RTMF, but a north-south belt of positive magnetic anomalies runs along the coast between the communities of Igloolik and Hall Beach. The southern part, near Hall Beach and offshore to the north, includes many oval to globular-shaped magnetic highs that generally are dimensionally small and tightly concentrated. Peak values are commonly a few hundred nT, with the exception of one circular high having a peak value >3400 nT. Of particular interest within the positive belt is a roughly 30 km-long, narrow chain of prominent globular highs trending north-northeast on the mainland south of Igoolik and then swinging northward across the channel to terminate on the small island on which Igoolik is located. Peak values along the narrower southern part of the chain are generally less than about 450 nT, but along the broader north-trending section are generally greater than 1000 nT with several ranging between approximately 3330 nT and 11730 nT, the latter value for a magnetic high very close to Igoolik. This chain of highs is reminiscent of the strong linear highs associated with Archean komatiite, basalt, rhyolite, dacite, andesite, banded iron formation and siliciclastic metasedimentary rocks to the southwest, but in this case are located on Phanerozoic sedimentary cover.

Approximately 30 and 35 km northwest of Igoolik the Archean unit containing the komatiite is exposed on two narrow peninsulas embracing Richards Bay (Corrigan et al., 2013). It is set within a unit of Archean felsic to intermediate plutons, orthogneiss and migmatite and is associated with a short, narrow, north-trending linear magnetic high running between the peninsulas. Even shorter east-trending linear highs are observed near the south end of the komatiite-bearing unit. Two linear highs branch away from the principal north-trending high. One is relatively short and runs east-northeastward in the bay. The second high branches from a point near the northern peninsula, running northeastward across the peninsula and offshore for some 35 km. Peak values of highs are commonly several thousand nT with values >10000 nT being observed.

Domain 52 (Figures 11, 12): Domain 52 is a belt-like domain running from the south end of Committee Bay northeastward approximately half way across Melville Peninsula. It is characterized generally by a moderately strong RTMF signature that includes some relatively large and irregularly-shaped areas of magnetic high and some distinct relatively short and narrow linear highs. The latter are sporadically distributed throughout mainly the southeastern half of the domain. Overall, as previously noted, the RTMF expression is similar to that of Domain 51 to the southeast. This is not surprising considering that the southeastern half of Domain 52, like most of the adjacent part of Domain 51, correlates with a unit of Archean felsic to intermediate plutons, orthogneiss and migmatite (Corrigan et al., 2013) that spans the boundary between the domains. The basis for the chosen position of the mutual boundary was a discernible stronger development of a linear pattern within Domain 51 and greater frequency of more extensive linear highs. It might not be unreasonable, however, to include the southeastern half of Domain 52 within Domain 51.

The RTMF along the northwestern margin of the northeastern third of Domain 52 essentially lacks a lineated fabric, being characterized in general by irregular areas of relatively positive expression of varying size separated in a few cases by small areas of background values of the field. The lack of linear fabric may be attributed to the plutonic nature of the unit of Late Archean felsic to intermediate intrusions designated as the Hall Lake suite (Corrigan et al., 2013) that covers most of this portion of the domain. Skulski et al. (2018) identify a unit having practically the same coverage as being composed of NeoArchean syn-volcanic biotite-hornblende tonalite (Atv). Noticeably, a large elongate prominent positive RTMF anomaly along the central portion of the northwestern margin correlates with a unit of Late Archean felsic intrusions and leucogranite partially enclosed by the Hall Lake Suite, and flanked to the south by a unit of Archean felsic to intermediate plutons, orthogneiss and migmatite (Corrigan et al., 2013). This Late Archean unit of felsic intrusions and leucogranite, somewhat surprisingly, is not defined on the map presented by Skulski et al. (2018). The prominent RTMF positive anomaly associated with the unit includes the strongest peak values along the northwestern margin, suggesting that a similar, but smaller and slightly less intense, irregular area of positive expression near the coast of Committee Bay may also signify the presence of Late Archean felsic intrusions and leucogranite.

Domain 53 (Figures 11, 12): Domain 53 is a relatively broad domain extending east-northeast across roughly two-thirds of the central part (north-south sense) of the Melville Peninsula. It is differentiated from Domain 52 to the southeast by the contrast in RTMF expression, which is generally relatively negative along the southeastern margin of the domain, and from Domain 51 to the east by the prevailing relatively negative and unperturbed RTMF signature of that domain. It is distinguished from Domain 54 to the north by a difference in textures of magnetic derivative images. The overall texture of magnetic highs in the tilt image within the domain is relatively open, compared to a more concentrated texture in Domain 54, a more lineated texture in Domain 52 and significantly more open texture in Domain 51. Aside from some extensive narrow linear magnetic highs related to roughly northwest-trending Franklin dykes and west-northwest-trending Mackenzie dykes (Corrigan et al., 2013) in the western half of the domain, most other linear highs are found along the northern margin trending roughly east-northeast. Generally, highs in the tilt image are small and globular or linear and short, collectively producing relatively open karst-like patterns. The more open patterns are associated with areas where the RTMF is weaker, which is mainly along the eastern margin and southwestern "corner" of the domain. These areas are underlain in large part by Late Archean felsic to intermediate intrusions of the Hall Lake suite.

Near the coast of Committee Bay an irregularly shaped belt of Archean komatiite, basalt, rhyolite, dacite, andesite, banded iron formation and siliciclastic metasedimentary rocks trends variably roughly north-northeast and northeast for over 50 km within the Hall Lake suite. Typically, it ranges in width from approximately a few hundred metres to 10 km. Like similar belts of these rocks within Domain 51 it is associated in places with very large positive RTMF anomalies having peak values that are commonly several thousand nT and attain >36000 nT. These probably reflect the banded iron formation within the unit. The southern half of the belt displays the closest correlation with a magnetic high, whereas most of the northern half, which is quite narrow and splits to embrace a small unit of Archean felsic to intermediate migmatitic orthogneiss (Corrigan et al., 2013), essentially lacks such a prominent signature. However, a small west-directed protrusion of the iron formation-bearing unit west of the orthogneiss unit touches on the peak (>36000 nT) of a roughly 9 km long magnetic high, signifying the presence of iron formation west of the iron formation-bearing unit as mapped. A west-striking linear high centred approximately 6 km south of the protrusion and entirely west of the iron formation-bearing unit attains a peak value >5600 nT again suggesting the presence of associated iron formation. Narrow units of Archean komatiite, basalt, rhyolite, dacite, andesite, banded iron formation and siliciclastic metasedimentary rocks along the eastern margin of the domain, flanked to the west by Late Archean intrusions of the Hall Lake suite and by Phanerozoic sedimentary cover to the east, are generally accompanied by prominent linear RTMF highs having peak values often measured in thousands of nT and attaining >14000 nT.

The northern half of the domain is underlain principally by units of (1) Archean felsic to intermediate plutons, orthogneiss and migmatite, (2) Late Archean felsic intrusions and leucogranite, and (3) Late Archean felsic to intermediate intrusions of the Hall Lake suite. The latter unit is restricted to the northeastern part of the domain and like areas of the unit in southwestern and southeastern parts generally is associated with a relatively weak magnetic field that is more or less ubiquitously perturbed by commonly small (dimensionally and in amplitude) globular and/or short linear highs. The unit of Archean felsic to intermediate plutons, orthogneiss and migmatite covers much of the central and western portions and typically displays a moderately strong magnetic field that is commonly perturbed by generally weak to moderate intensity, small (spatially) highs. There is a hint of a preferred northeast orientation for some of the longer linear RTMF highs along the northwestern margin of the unit (more distinct in derivative magnetic images). The third unit, Late Archean felsic intrusions and leucogranite, produces the strongest magnetic signatures in the domain. This is well exemplified by a portion of the unit near the coast of Committee Bay in the northwestern corner of the domain, and by a large isolated area of the unit in the eastern half of the domain. A narrow, roughly east-northeast-trending belt of these intrusive rocks produces a moderately strong linear magnetic anomaly in the northeast corner of the domain. A group of dimensionally small, but moderately strong highs along strike to the west-southwest may signify the presence of unmapped Late Archean felsic intrusions and leucogranite within an area mapped as Archean felsic to intermediate plutons, orthogneiss and migmatite (Corrigan et al., 2013).

Domain 54 (Figures 11, 12): Domain 54 is clearly differentiated from Domain 51 by its consistently prominent positive RTMF expression that contrasts strongly with the relatively subdued signature of the latter. Differentiation from Domain 53 is more nebulous since the marginal region of this domain is also characterized by a strong positive magnetic expression. The boundary position in this case is based on a difference in trend of narrow, linear derivative anomalies, with approximately east-northeast-trending linears consistently present along much of the boundary within Domain 53 and roughly northeast trends observed for fewer linear anomalies within Domain 54.

Some of the more prominent linears in both domains fall within a broad unit of Late Archean felsic intrusions and leucogranite (Corrigan et al., 2013) trending roughly northeast obliquely across the south-southwestern portion of the boundary. Skulski et al. (2018) display a roughly equivalent unit in terms of area also obliquely crossing the boundary and designated as NeoArchean granodiorite (Agd). The difference in trends within this intrusive unit either side of the domain boundary signifies a possible structural break separating portions characterized by different structural fabrics. This example highlights the fact that magnetic domains do not necessarily define areas of the crust characterized by lithological homogeneity and that structural characteristics can be a strong influence on definition of magnetic domains.

Domain 54 is closely coincident with a segment of the crust termed the Northern Granulite Block (Corrigan et al., 2013), cored by an Archean unit of predominantly charnockite and mangerite gneiss and retrograde metamorphic equivalents that yields a ubiquitous moderately strong positive RTMF signature; most of the broader western portion of this unit is identified as NeoArchean orthopyroxene-tonalite (Age) by Skulski et al. (2018). Relatively short, narrow linear highs having various orientations are sporadically superposed on this RTMF signature, though not always prominent and revealing no sense of a pervasive linear fabric. Nevertheless, the linears are clearly portrayed in the derivative magnetic images, and some linear fabrics can be discerned locally.

The broad unit of Late Archean felsic intrusions and leucogranite lying along the southern margin of the charnockite-mangerite gneiss unit (Corrigan et al., 2013), together with several smaller units scattered within the northern half of the gneiss unit, covers a significant part of the domain. This broad unit is associated with a noticeably stronger magnetic field with peak values commonly in the range from about 200 nT to 1200 nT, whereas peak values over the charnockite-mangerite gneiss unit are often <200 nT. An area of strong peak values extending westward from the unit of felsic intrusions and leucogranite suggests the presence of unmapped or shallowly buried portions of that unit within the charnockite-mangerite gneiss unit.

A portion of the northern margin of Domain 54 is underlain by Archean felsic to intermediate intrusions, orthogneiss and migmatite according to Corrigan et al. (2013), or NeoArchean undifferentiated granitoid rocks (Agu) based on the map of Skulski et al. (2018). The area is associated with a moderately strong RTMF displaying several narrow linear magnetic highs oriented approximately W30^{O}N parallel to the domain boundary and boundary with the charnockite-mangerite gneiss unit to the south. Several strong peak values of several hundred nT that attain about 875 nT suggest that small units of Late Archean felsic intrusions and leucogranite (Corrigan et al., 2013) may be present within this marginal area.

The eastern "nose" of the domain is underlain by Phanerozoic (Ordovician and Silurian) sedimentary rocks and characterized by a positive RTMF that presumably reflects the east-southeastward and eastward extrapolation, respectively, of units of felsic to intermediate plutons, orthogneiss and migmatite and of Archean predominantly charnockite and mangerite gneiss and retrograde metamorphic equivalents (Corrigan et al., 2013) under the Phanerozoic cover. The magnetic field is somewhat muted over the Phanerozoic.

Noticeably, conspicuous, narrow linear to curvilinear magnetic lows, many extensive, are observed in all magnetic images of the domain. The trends of linear lows, or of portions of curvilinear lows, generally lie between about west-northwest and W5°S. The lows are distributed across the domain from the north to south boundary, crossing most of the domain in an east-west sense. Spacing varies from about 3 km to 20 km, but a more characteristic nominal spacing would be about 7 km to 13 km. Such magnetic lows are hallmarks of faults and most of them correlate with faults on a figure of the geology of Melville Peninsula (Corrigan et al., 2013). It is presumed that aeromagnetic maps were utilized in delineating these faults.

Domain 55 (Figures 11, 12): Domain 55 is a narrow northeast-trending domain characterized by very strong narrow, linear RTMF anomalies oriented generally approximately east-northeast to northeast. Characteristically, these are fairly extensive and continuous, but shorter and discontinuous examples exist. In the narrowest portions of the domain only one strong linear high is present, but in wider portions up to 4 sub-parallel highs are observed. Between the highs the magnetic field is relatively flat at a level that is relatively negative with respect to the estimated general background level of the field. Near the southwestern end of the domain, at two localities about 45 km apart, two groups of generally short linear magnetic highs trending between roughly north and northwest, together with the magnetic characteristics of adjacent areas contribute to the irregular path of the northwestern boundary in this area.

The southeastern boundary of the domain is noticeably displaced in a dextral sense near the centre of the domain. The line of displacement is coincident or near-coincident with the Walker Lake shear zone (Skulski et al., 2018). Geological mapping in the area of the domain apparently is more detailed than in many other areas, possibly resulting from an economic interest in the iron formations mapped within NeoArchean supracrustal rocks of the Committee Bay and Woodburn groups (units ACWs, ACWmv, ACWk) and within undifferentiated NeoArchean supracrustal rocks (As). The former are more prevalent in the southwestern half of the domain, and the latter in the northeastern half. Most of the magnetic highs correlate with mapped iron formations. Highs correlating with supracrustal units lacking mapped iron formations strongly indicate their presence, perhaps unnoticed in mapping because of extensive overburden.

The supracrustal rocks form narrow units following the trend of the domain, and are accompanied by wider units of other rock-types having the same general trend. Units of NeoArchean tonalite and quartz diorite (Ato) cover most of the domain, and units of NeoArchean granodiorite of the Snow Island Suite (Agd) make a significant contribution. There are also smaller areas of mainly Palaeoproterozoic granite of the Hudson Suite (PHg), NeoArchean monzogranite to granodiorite (Ags), Archean-Proterozoic anorthosite, anorthositic gabbro and associated gabbro (Apa), and NeoArchean gabbro and diorite (Adg) (Skulski et al., 2018). NeoArchean porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg) running along the eastern margin of portions of the northeastern part of the domain belongs to a very large unit of these rocks occupying most of adjacent Domain 43 to the southeast. Much of the negative background levels of magnetic field within the southwestern portion of the domain, e.g., adjacent to the Walker Lake shear zone, are associated principally with the centrally located unit of NeoArchean tonalite and quartz diorite (Ato).

Domain 56 (Figures 11, 12): Domain 56 is an irregularly shaped domain having an overall northeastward trend defined primarily by its relatively subdued RTMF, in comparison to the noticeably positive fields of adjacent Domains 55 and 57 to the southeast and northwest, respectively. An exception is the similar subdued RTMF expression of Domain 62 to the northeast, the mutual boundary here being based on strongly contrasting patterns of linear derivative magnetic highs. In fact, the domain could be defined on contrasting patterns of linear derivative highs with all adjacent domains. With the exception of some generally continuous, northwest-trending narrow linear derivative highs that correlate with mapped Mesoproterozoic Mackenzie dykes (PMd) (Skulski et al., 2018) there are few other linear highs. These are not very extensive with some highs better described as globular than linear.

The aforementioned highs are concentrated in essentially two areas within the southwestern half of the domain. One area lies northwest of the conspicuous southward protrusion of the domain into Domain 55, which is influenced by the coincident presence of a large, roughly oval-shaped body of NeoArchean synvolcanic biotite-hornblende tonalite (Atv). Here, the highs are short and oriented in various directions, including northwestward, northeastward, east-northeastward, west-northwestward and east-west, and globular highs are also present. The second area lying farther southwest, within the broader southern end of the domain, also includes short linear highs that are bead-like and globular highs, the linear varieties favouring a north-northeastward orientation.

Many of these highs correlate with mapped iron formation hosted mainly by units of NeoArchean mainly metasedimentary rocks of the Committee Bay and Woodburn groups (ACWs) or NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx). Together, these units probably cover most of the southern half of the domain. It is proposed that other highs falling on these units may also signify the presence of iron formation.

The very short lengths of RTMF highs associated with iron formations in Domain 56 contrast noticeably with the much longer lengths of counterparts in Domain 55. Another big difference is in the peak values of the highs, with the highest value in Domain 56 being just over 1000 nT, whereas in Domain 55 values > 1000 nT are common and many attain several thousand nT. The difference in peak values could be influenced by preserved thickness of the iron formation and the type of iron formation, which would have a bearing on the magnetic susceptibility. Certainly the magnetic anomalies in Domain 55 are much more extensive, suggesting greater preservation of iron formation, and it is noted that many highs are associated with NeoArchean Committee Bay and Woodburn groups formed of komatiite, komatiitic basalt, and related ultramafic intrusive rocks (ACWk) and with NeoArchean undifferentiated supracrustal rocks that include metasediments, and may include some mafic and ultramafic volcanic rocks (As) (Skulski et al., 2018). Such komatiitic and ultramafic rocks could themselves contribute to the magnetic highs.

The supracrustal groups that host iron formation cover roughly half of Domain 56, with NeoArchean monzogranite to granodiorite (Ags), mapped largely within the northern portion of the domain and also along the southwestern margin, completing the coverage. These supracrustal and granitoid rocks are associated with the generally subdued background magnetic field that typifies much of the domain. Four bodies of NeoArchean tonalite and quartz diorite (Ato) in the southeastern corner of the domain seemingly produce no expression in the magnetic field.

Domain 57 (Figures 13, 14): Domain 57 is an elongate (~330 km) domain having the shape of a spearhead pointing roughly W30^{O}S. The greater part of the southern edge of the spearhead coincides precisely with the Amer shear zone. The domain is defined by its positive signature in the RTMF image that contrasts with the relatively flat and smooth expressions of adjacent Domains 56 and 58, and also by the contrasting textures of patterns of derivative magnetic highs and orientations of narrow linear highs observed within the domain and within adjacent Domains 42 and 59.

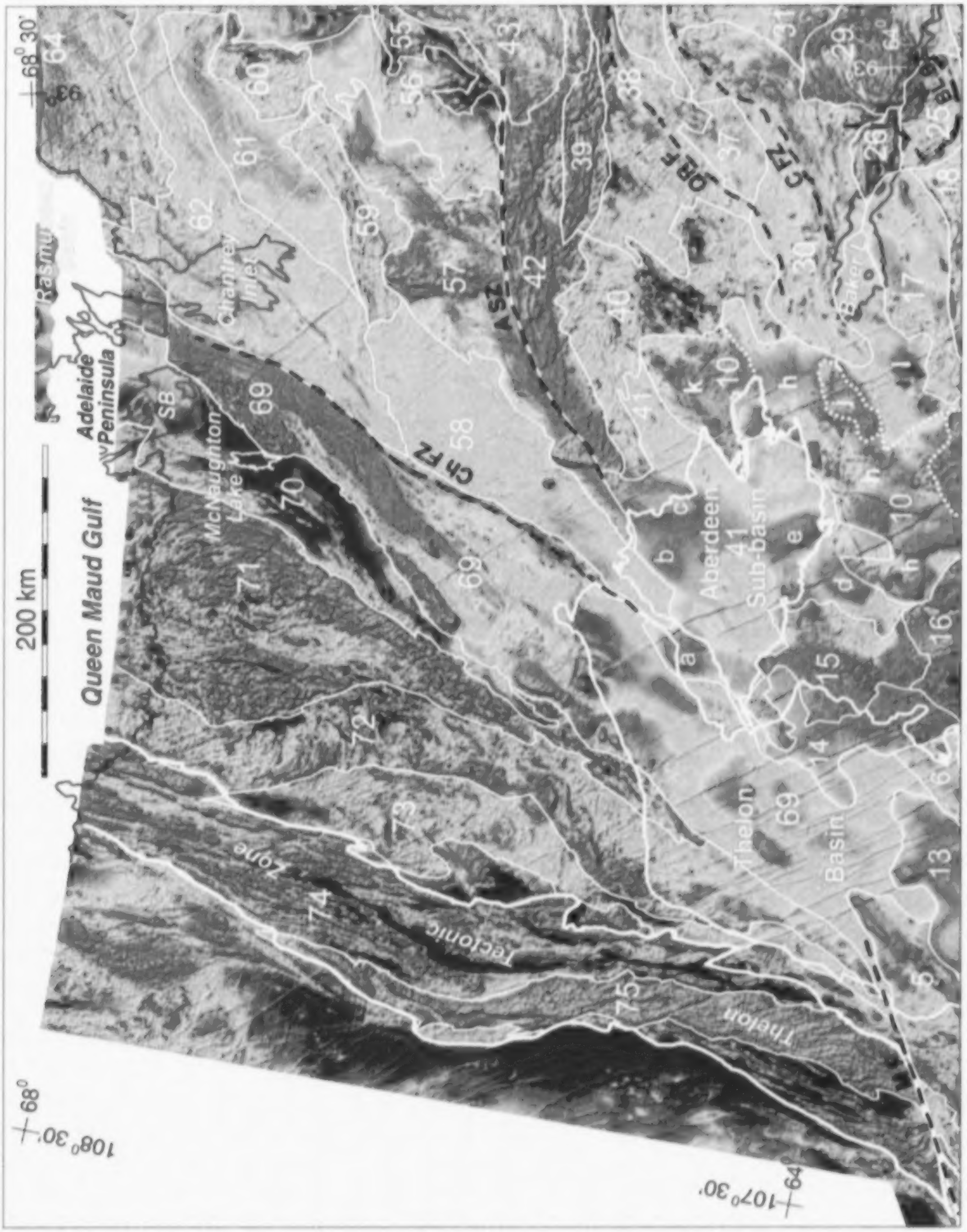
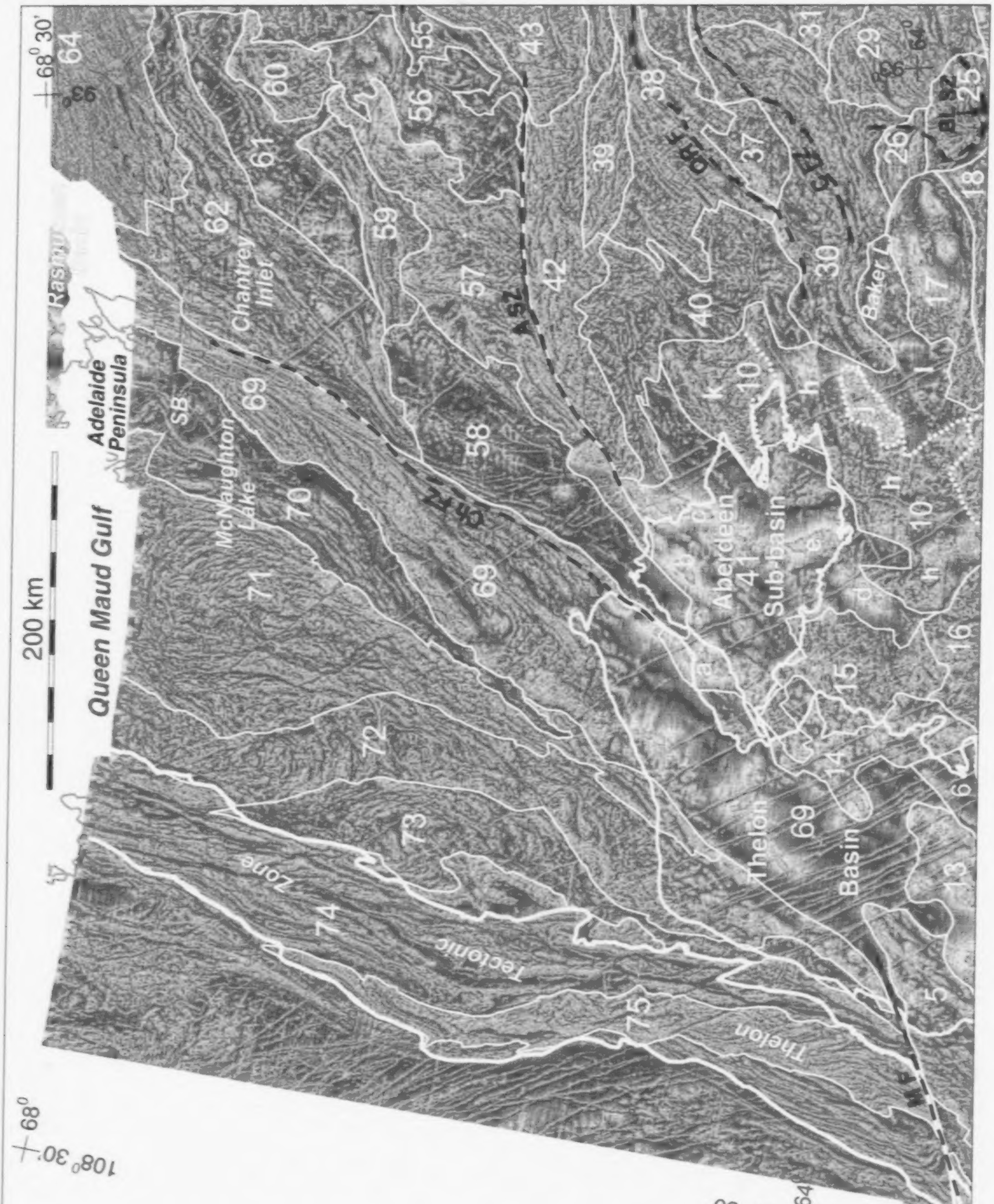

68° 30'
96°
64
200 km
Queen Maud Gulf
Adelaide Peninsula
Chantrey Inlet
McNaughton Lake
SB
Ch FZ
A SZ
QR F
C FZ
BL SZ
Baker L
Aberdeen Sub-basin
Thelon Basin
Thelon Tectonic Zone
68°
108° 30'
107° 30'
64°

Figure 13: Map of residual total magnetic field for northwestern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: A SZ, Amer shear zone; BL SZ, Big Lake shear zone; C FZ, Chesterfield fault zone; Ch FZ, Chantrey fault zone; M F, McDonald fault; QR F, Quoich River fault.


200 km
Queen Maud Gulf
Adelaide Peninsula
Rasmu
Chantrey Inlet
McNaughton Lake
SB
Ch FZ
A SZ
QR F
C FZ
BL SZ
Baker L.
Aberdeen Sub-basin
Thelon Basin
Thelon Tectonic Zone
M F
68° 30'
93°
64°
96°
68°
108° 30'
64°
107° 30'
64
60
55
43
31
29
25
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18
56
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10
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70
71
72
73
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75
41
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k
h
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e
a

Figure 14: Map of tilt of residual total magnetic field for northwestern portion of the study area with boundaries of magnetic domains and subdomains superposed. Geological features: A SZ, Amer shear zone; BL SZ, Big Lake shear zone; C FZ, Chesterfield fault zone; Ch FZ, Chantrey fault zone; M F, McDonald fault; QR F, Quoich River fault.

A prominent feature of the domain is a roughly arch-shaped magnetic high in the RTMF that produces a northward-facing bulge on the northern boundary of the domain roughly half way along the narrow tip of the spearhead. This coincides precisely with a similarly shaped body of Palaeoproterozoic porphyritic rapakivi granite of the Nueltin Intrusive Suite (PNg) (Skulski et al., 2018). The southern contact of the granite is coincident with the Amer shear zone indicating a faulted contact. A search for a displaced counterpart on the south side of the shear zone did not reveal any potential anomalies indicative of any such intrusion.

Within the southwest tip of the domain two sub-parallel, narrow discontinuous linear RTMF highs trending roughly northeast, better defined in the derivative magnetic images, fall within a broad unit of metamorphosed, mainly metasedimentary, Palaeoproterozoic cover rocks (Ps4). Possible sources are metabasalt or gabbro that may occur locally within the cover sequences (Skulski et al., 2018). These highs terminate to the northeast as the geology changes to NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg), lying between the cover rocks and the arch-shaped rapakivi granite intrusion to the northeast. The RTMF over the granodiorite is relatively unperturbed aside from 3 narrow, linear magnetic highs trending roughly northwest related to mapped Mackenzie dykes (PMd) (Skulski et al., 2018). Possibly, Mackenzie dykes are also associated with 3 other linear highs trending N10^{O}W to N15^{O}W across the granodiorite.

Northeast of the porphyritic rapakivi granite (PNg) NeoArchean mixed gneiss (Amgn) occupies almost the entire width of the domain approximately as far northeast as its widest dimension, and is associated practically everywhere with a strong positive RTMF signature. The field is strongest along the southeastern margin in the southwest where the domain is relatively narrow and in the east where the domain attains its greatest width; between these two areas the field is weaker, but still prominently positive. Narrow linear magnetic highs are observed in all three of these sub-areas, trending roughly northeastward or east-northeastward in the southwest, northward in the east and roughly east-northeastward in the intervening area. The widespread association of these highs with the mixed gneiss unit (Amgn) suggests that the linear magnetic highs in all sub-areas are to a large extent mapping gneissic layers/units of different composition within the unit. There is good evidence for other sources for some magnetic highs in the southwestern and eastern sub-areas.

In the southwest, short sections of highs correlate with a few small areas of supracrustal rocks of the NeoArchean Committee Bay and Woodburn groups that include mafic and minor felsic volcanic rocks interbedded with iron formation, mafic tuffs, pelitic metasedimentary rocks and felsic pyroclastic rocks (ACWmv). The pattern of the highs in the areas of supracrustal rocks suggest that these groups may have a more extensive distribution than current geological mapping (Skulski et al., 2018) displays. In the east, a northward-trending, broad belt of strong magnetic field correlates with a large body of NeoArchean orthopyroxene-granite/granodiorite (Agc) at the northern boundary of the domain where it is widest. The body is elongate north-south in harmony with the trend of the belt and its component linear highs, which extend southward beyond the body across the mixed gneiss (Amgn) to the southern boundary of the domain, providing strong evidence for the presence of orthopyroxene-granite/granodiorite (Agc) at shallow depth beneath the mixed gneisses.

The eastern part of the extensive unit of NeoArchean mixed gneiss (Amgn) underlying the widest portion of the domain, potentially beyond the influence of the proposed buried orthopyroxene-tonalite rocks, is characterized by a reasonably strong RTMF expression and generally roughly northeast-trending linear highs. Noteworthy is a narrow linear magnetic high running northeastwards for over 90 km from the Amer shear zone and crossing successively NeoArchean mixed gneiss (Amgn), NeoArchean monzogranite to granodiorite (Ags) and NeoArchean undifferentiated supracrustal rocks (As). It runs through the widest part of the spearhead well into the narrow northeastern shaft. This is interpreted to reflect a dyke, though no dyke in this position appears on the map by Skulski et al. (2018).

The area of the northeastern shaft is underlain by mainly NeoArchean monzogranite to granodiorite (Ags) and substantial areas of NeoArchean mixed gneiss (Amgn), NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg) and NeoArchean undifferentiated supracrustal rocks (As). The boundary between the mixed gneiss (Amgn) and monzogranite to granodiorite (Ags) units marks a change to a stronger RTMF over the NeoArchean mixed gneisses (Amgn), though the change is not distinct enough to permit magnetic mapping of the boundary. Linear magnetic highs within the mixed gneisses are attributed to gneissic layers/units of different composition. Those within the monzogranite to granodiorite unit (Ags) are more difficult to explain. However, rocks of the unit are variably foliated and lineated, and abundant metasedimentary and amphibolitic schlieren, screens and rafts are present (Skulski et al., 2018). Such features could possibly be related to some of the highs.

The areas of NeoArchean K-feldspar porphyritic granodiorite of the Snow Island Suite (Akg) and NeoArchean undifferentiated supracrustal rocks (As) near the northeast end of the domain apparently have little influence on the magnetic field, and it speculated that the magnetic field signature in this area reflects mainly NeoArchean monzogranite to granodiorite (Ags) buried at very shallow depth beneath the porphyritic granodiorite and supracrustal rocks.

Domain 58 (Figures 13, 14): Domain 58 is defined by its subdued and generally smooth RTMF. The level of the field is at background levels and there are relatively few minor perturbations. Compared to adjacent domains the pattern of derivative magnetic highs is open with no great concentration of highs. The domain is belt-like and about 250 km long, striking northeast from the area of the northwest corner of the Aberdeen sub-basin, which it overlies locally. The wider northeastern half of the domain and much of the southwestern half is underlain by a large unit of NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg), whereas the remainder of the southwestern half is formed mainly of monzogranite and granite pegmatite (Amg) of the suite (Skulski et al., 2018). These two groups of rock-types apparently have similar magnetic properties with weak susceptibilities responsible for the subdued field.

The perturbations that disturb the RTMF are generally very narrow linear highs of various extents. Some of the more noticeable are oriented northwest and coincide with Mackenzie dykes (PMd). A few others do not coincide with such dykes, but point to their presence based on their northwest orientation. Several other noticeable linear highs in the derivative images traverse the unit of Snow Island Suite K-feldspar porphyritic granodiorite (Akg) in the central (east-west sense) part of the domain. These do not correlate with any mapped dykes, but probably reflect dykes. Their orientation ranges between roughly north-northwest and north-northeast, which differs from the more typical northwest trend of Mackenzie dykes in this general area of the Rae craton. Thus, they may be indicative of some other group of dykes, though a link with Mackenzie dykes cannot be discounted.

A number of distinct northeastward-trending linear highs, some fairly extensive, are also observed. Several of these, or portions thereof, fall upon a narrow, northeastward-trending belt of Assemblage 4 of metamorphosed and mainly metasedimentary Palaeoproterozoic cover sequences (Ps4) close to the southeastern margin of the domain. The principal rock-types are sandstone, arkose, siltstone and mudstone (Skulski et al., 2018), none of which would seemingly be a good candidate for the source of the highs. However, a polymictic conglomerate occurring locally contains clasts of mafic rocks, which, depending on their magnetic susceptibility and abundance, could be a potential source. In units of cover sequences (Ps) for which individual assemblages are not distinguished, metabasalt and gabbro are present locally; possibly such potentially magnetic rock-types are included in the Ps4 unit. Northeastward-trending highs that traverse only the granitoid rocks of the domain, occurring along and oriented sub-parallel to the northwestern and southeastern boundaries of the domain and in the central part (east-west sense) of the northern part of the domain potentially indicate the possible presence of similar Palaeoproterozoic cover sequences.

A prominent magnetic anomaly of interest is the circular, roughly 9 km diameter, RTMF anomaly having an amplitude of about 675 nT located within the unit of NeoArchean feldspar porphyritic granodiorite of the Snow Island Suite (Akg) near its southwestern end. It is speculated that this might be the signature of a kimberlite pipe or carbonatite intrusion.

Domain 59 (Figures 13, 14): Domain 59 is defined principally by a conspicuous pattern of fairly extensive and continuous parallel to sub-parallel magnetic highs in the RTMF trending generally eastward to east-northeastward, matching the overall trend of the domain. These highs contrast strongly with the subdued and relatively flat magnetic fields of adjoining Domains 58 and 61 to the west and north, respectively. The trends of derivative linear highs within the domain contrast with the trends of highs within Domain 57 to the south, several of which are oriented northward or roughly northward near the mutual boundary. The magnetic characteristics of Domain 59 are closely similar to those of Domain 60 approximately 10 km along strike to the northeast. The domains are identified as separate units on the basis of a break in the pattern of narrow linear magnetic highs over this 10 km distance, where the field is relatively subdued. This area of subdued magnetic field is included within Domain 61, which is generally characterized by a subdued magnetic response.

Roughly two-thirds of the domain (northeastern end) is underlain by NeoArchean monzogranite to granodiorite (Ags) (Skulski et al., 2018) with a significant area of NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg) in the northeast corner, and a much smaller area in the northwestern corner. These units and the contact between them have a general northeast orientation. The southwestern third of the domain is underlain mainly by a substantial elongate, roughly east-northeast-trending unit of Archean-Proterozoic granulite that includes hypersthene paragneiss, migmatite, diatexite and/or mafic gneiss (APgp) (Skulski et al., 2018).

The dominating unit of monzogranite to granodiorite (Ags) is associated with most of the RTMF linear highs, though the field is weaker and highs are much less discernible along the southern margin where the domain is widest and bulges southward. The unit is described as variably foliated and lineated, and containing abundant metasedimentary and amphibolitic schlieren, screens and rafts (Skulski et al., 2018), characteristics and features that presumably generate the linear nature of associated magnetic anomalies. In the northeast corner of the domain, coinciding with a unit of NeoArchean K-feldspar porphyritic granodiorite of the Snow Island Suite (Akg), the field is also weaker, but displays northeast-trending, discontinuous linear highs. A similar picture is observed over the large unit of granulite grade gneisses (APgp) at the west end of the domain, where the magnetic field is relatively weak, but hints at the presence of sub-parallel linear highs in the form of sporadic collinear globular highs. The picture of sub-parallel highs is enhanced in the derivative magnetic images. The highs over the granulitic gneisses (APgp) may be attributed to compositional layering, but sources within the igneous porphyritic granodiorite (Akg) are uncertain.

Domain 60 (Figures 13, 14): Domain 60, as noted, has similarities in its magnetic signature to that of Domain 59. It could be argued that the two domains could be coalesced into a single domain, if the small area of disruption of linear pattern between them is ignored. Domain 60 is not as extensive as Domain 59, but maintains the same general northeast trend. Like Domain 59 a belt of sub-parallel linear highs, or a singular high, trends northeastward along the northwestern margin of the domain. In contrast, a narrow belt of magnetic highs along the eastern margin trends northward.

Geologically it seems that more detailed mapping has taken place within the domain with many generally narrow, northeast-trending, belt-like or lense-shaped units of diverse rock-types being present. These units are set within two units that are more widespread and host the smaller units. One is a unit of NeoArchean monzogranite to granodiorite (Ags), covering much of the eastern and southeastern portion of the domain and southwestern margin. The other is a unit of NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg), present mainly along the northwestern margin.

Several lense-shaped units of NeoArchean paragneiss, migmatite, metatexite, and diatexite (Adx) are scattered within the porphyritic granodiorite unit (Akg). Linear magnetic highs within this northwestern marginal area display limited correlation with these lense-shaped units, though the largest lense correlates closely with a prominent positive magnetic signature shown to comprise two linear highs in derivative images. Some portions of linear highs fall on the unit of porphyritic granodiorite (Akg), and near the northwest corner of the domain linear highs apparently cut across contacts between this unit and the monzogranite to granodiorite unit (Ags). This questions the accuracy of contact positions, and raises the possibility of gradational contacts between the two units.

The sources of the north-trending, strong linear highs along the eastern margin of the domain are not everywhere apparent. In the south, where the magnetic high is widest and somewhat irregular in shape, it seems to correlate with a northward-trending, roughly lense-shaped unit of NeoArchean tonalite and quartz diorite (Ato). However, as this magnetic high narrows northward it traverses NeoArchean monzogranite to granodiorite (Ags) and then a unit of NeoArchean undifferentiated supracrustal rocks (As). Northward again the high is replaced by sub-parallel highs that run to the northern margin of the domain, traversing almost exclusively the background units of NeoArchean monzogranite to granodiorite (Ags) and NeoArchean K-feldspar porphyritic granodiorite (Akg), and crossing unit boundaries without noticeable change. The northward trend of the magnetic highs contrasts with the persistent northeast trend of the few smaller geological units scattered throughout this general area.

A strong RTMF high occupies (and defines) an eastward-directed protuberance at the northeast corner of the domain that coincides mainly with NeoArchean monzogranite to granodiorite (Ags). The occurrence of a small elongate oval-shaped body of Palaeoproterozoic granite of the Hudson Suite (PHg) within the middle of the protuberance suggests the granite as a probable source, even though its dimensions are considerably smaller than those of the magnetic high. Skulski et al. (2018) noted that the granite may contain disseminated magnetite.

Domain 61 (Figures 13, 14): Domain 61 is a northeast-trending elongate domain roughly 210 km long, whose relatively quiet magnetic response contrasts noticeably with the stronger linear magnetic patterns of Domains 59 and 60 to the southeast. It is distinguished from the portion of Domain 62 to the northwest, also characterized by a generally subdued magnetic field, by a difference in texture of the derivative and RTMF patterns. In Domain 61 positive anomalies are few, globular in shape and widely scattered, whereas in Domain 62 a linear pattern of magnetic highs is widely developed and anomalies are more concentrated. Domain 61 is crossed by some distinct northwest-trending, very narrow linear highs, which correlate with mapped Mackenzie dykes (PMd) (Skulski et al., 2018). One very weak and discontinuous northwest-trending linear high correlates with a NeoProterozoic Franklin dyke (PF). The boundary with the portion of Domain 62 to the east is defined by a change from a loose concentration of derivative magnetic highs within the domain to a perceptibly tighter concentration within Domain 62.

Apart from prominent dyke-related linear anomalies the magnetic field over the domain is relatively little perturbed. One discernible feature is a series of weak, and sometimes discontinuous, narrow linear, northeast-trending magnetic highs in the northeast half of the domain, where they are better developed along the southeastern margin. A relationship of individual highs with a specific geological unit is not apparent. The closest correlation with a geological feature is that for the most extensive and best developed magnetic high, which is coincident or near-coincident with, or no more than about 1700 m from, a northeast-trending shear zone (Skulski et al., 2018) for most of its length. It is speculated that the shear zone contains magnetite that could generate such an anomaly.

Some weakly-developed, discontinuous and short linear highs apparent in the derivative images northwest of the western end of the shear zone traverse units of NeoArchean tonalite and quartz diorite (Ato) and NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg). Other short, weak linear highs either side of the central portion of the shear zone are located on the latter unit (Amg) and on units of NeoArchean monzogranite to granodiorite (Ags), NeoArchean K-feldspar porphyritic granodiorite of the Snow Island Suite (Akg), NeoArchean tonalite and quartz diorite (Ato) and NeoArchean undifferentiated, mainly metasedimentary supracrustal rocks (As).

The weak magnetic field over the southwestern half of the domain contains some scattered low amplitude perturbations in the RTMF. These are more evident in the derivative images, showing up generally as very short narrow linear or small oval-shaped highs. These features are located variously within reasonably large areas of NeoArchean granodiorite of the Snow Island Suite (Agd), NeoArchean tonalite and quartz diorite (Ato) and NeoArchean orthopyroxene-granite/granodiorite (Agc).

The RTMF is subdued also over most of the northeastern half of the domain, reaching its lowest levels over a sizable area northwest of the major shear zone. The principal perturbations are previously described northwest-trending narrow, linear highs related to mapped dykes and some weak northeast-trending linear magnetic highs. The greater part of this area is perhaps underlain by NeoArchean tonalite and quartz diorite (Ato) together with NeoArchean K-feldspar porphyritic granodiorite of the Snow Island Suite (Akg). There are also significant areas of NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg), NeoArchean monzogranite to granodiorite (Ags) and NeoArchean undifferentiated supracrustal rocks (As). All of these units and contacts between them trend generally approximately northeast to east-northeast.

Southeast of the shear zone at the eastern end of the domain, much of the RTMF is relatively negative, though perturbed by some distinct positive linear anomalies. The latter are not very extensive and trend roughly north-northwest or east-west. The "background" geological unit is NeoArchean porphyritic granodiorite of the Snow Island Suite (Akg) within which are smaller NeoArchean units of tonalite and quartz diorite (Ato), monzogranite to granodiorite (Ags), undifferentiated supracrustal rocks (As) and paragneiss, migmatite, metatexite, and diatexite (Adx). A fairly extensive, roughly east-west unit of the latter rocks, swinging northward at its eastern end, separates small geological units and linear magnetic highs having a north-northwestward trend to the north from counterparts having a roughly east-northeastward trend to the south. The stronger magnetic highs in this area do not appear to correlate with a singular geological unit, but tend to fall within the "background" geological unit of NeoArchean K-feldspar porphyritic granodiorite (Akg).

Domain 62 (Figures 11, 12): Domain 62 is a large domain wrapping around Domains 56, 60 and 61, which essentially divide it into western and eastern sectors joined by a narrow connection between Domains 61 and 64. The domain is defined on the basis of two criteria: (1) its generally suppressed RTMF compared to fields of most surrounding domains, and (2) textural differences in the concentration of magnetic highs in the derivative images. Characteristically, the western sector of Domain 62 has a subdued RTMF similar to that associated with adjacent Domains 58 and 61 to the south, but is distinguished from those domains by a tighter concentration of magnetic highs in the derivative magnetic images, and from Domain 69 to the west by the contrasting strong, widespread positive RTMF of the latter. Delineation of the eastern sector is based on its more subdued magnetic response, and weaker concentration of derivative magnetic highs compared to stronger responses and/or concentrations in adjacent Domains 55, 60, 63 and 64. Differences in trend of narrow linear magnetic highs either side of the boundary of Domain 62 also played a role in its definition.

Most of the western boundary of the domain is coincident or near-coincident with the Chantrey fault zone (Skulski et al., 2018). The western sector of the domain is characterized by a strong northeast-trending magnetic grain, with narrow linear highs of varying extent occurring at fairly regular intervals across its width. This sector embraces Chantrey Inlet, across which magnetic coverage is continuous, and east and south of which NeoArchean granodiorite of the Snow Island Suite predominates (Agd). Southwest of Chantrey Inlet NeoArchean undifferentiated granitoid rocks (Agu) predominate, but include a large northeast-trending, wedge-shaped enclave of the NeoArchean granodiorite (Agd). Typically, many of the linear magnetic highs in the derivative magnetic images are weakly represented in the RTMF image. There are, however, some prominent linear RTMF highs, some quite extensive, extending along the western margin and central portion of the western sector of the domain. All of them are preferentially associated with the unit of NeoArchean undifferentiated granitoid rocks (Agu), whereas generally weaker and less extensive linear highs are associated with the unit of NeoArchean granodiorite of the Snow Island Suite (Agd). A distinct narrow belt of metamorphosed, mainly metasedimentary, Palaeoproterozoic cover sequence (Ps3, Ps4) running northeast from Chantrey Inlet is not associated with a discernible magnetic anomaly.

In the narrow portion of the domain connecting western and eastern sectors, linear magnetic highs in the derivative images die out eastward, with the odd one that seemingly does not swinging from a northeast to an east-northeast trend more typical of some trends in the western portion of the eastern sector of the domain. It is difficult to determine, however, whether there is a definite link between linear anomalies in the connecting zone and those in the eastern sector. Part of the problem is the general lack of linear anomalies of significant extent at the east end of the zone. The dominating geological unit in the connecting zone is NeoArchean tonalite and quartz diorite (Ato), but presumed detailed mapping in this area has outlined many small narrow elongate or lense-shaped units of NeoArchean granodiorite of the Snow Island Suite (Agd), NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg), NeoArchean undifferentiated supracrustal rocks (As), NeoArchean gabbro and diorite (Adg) and metamorphosed, mainly metasedimentary Palaeoproterozoic cover sequences (Ps3, Ps½). Most of these units trend variously between roughly northeast to east-northeast in harmony with the trends of linear magnetic highs. Several of these units, of different lithological composition, are associated with some of the linear magnetic highs, others are not, or only partially, associated. Several highs also are located within the "background" unit of NeoArchean tonalite and quartz diorite (Ato).

The magnetic patterns for the eastern sector of the domain lack coherency, with no discernible dominant trends of elongate anomalies. The RTMF image displays a generally weak field that is everywhere disturbed by small high frequency perturbations that are circular to oval-shaped or short, narrow and linear distributed in somewhat chaotic patterns. This is an example of a karst-like appearance. The patterns of derivative anomalies are similarly irregular with generally short narrow linear to curvilinear magnetic highs oriented in various directions and mixed in with small globular highs. Hints of alignment of some linear elements occur sporadically, but typically orientations vary throughout the eastern sector of the domain.

The irregular magnetic patterns are surprising, considering that geological units throughout most of the eastern sector are narrow and belt-like and trend more or less uniformly northeast. Such a pattern of geological units would be expected to be reflected in the magnetic field with linear magnetic anomalies trending northeast. The northeast geological trends are interrupted near the central part of the eastern sector (north-south sense) by a broad belt of geology within which dominant trends of units and contacts are oriented roughly west-northwest. The belt itself has a roughly west-northwest orientation, though does not extend the full width of the domain. It lies just south of an approximately 230 km-long fault zone trending roughly E5^{O}S (Skulski et al., 2018). Some linear magnetic highs within this belt do have the west-northwest trend of the geological trends, though a strong pattern is not established.

North of the belt, linear northeast-trending belts of different rock-types alternate variously with one another. These range from about 1 km to 15 km in width and are accompanied by many less extensive and sometimes narrower (<1 km wide) ribbons and lenses. These units are all NeoArchean and include mainly granodiorite of the Snow Island Suite (Agd), K-feldspar porphyritic granodiorite of the Snow Island Suite (Akg), monzogranite and granite pegmatite of the Snow Island Suite (Amg), tonalite and quartz diorite (Ato), gabbro and diorite (Adg) and biotite-muscovite granite (Abm). Comparison of these units with the magnetic signatures does not reveal close correlations or easy recognition of a particular association of a signature with a geological unit.

Within the west-northwest-trending belt the geology is characterized by geological units or portions thereof trending generally west-northwest over distances up to about 50 km. Broad units of NeoArchean tonalite and quartz diorite (Ato) and NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx) dominate this belt, with NeoArchean units of monzogranite to granodiorite (Ags), K-feldspar porphyritic granodiorite ± hornblende ± magnetite (Akg), and granodiorite (Agd) belonging to the Snow Island Suite making noticeable contributions. The two larger units are truncated along their eastern margins by a northeast-trending unit of the NeoArchean granodiorite (Agd) that here forms the eastern marginal area of the domain. Here again, as is the case north of the aforementioned fault zone, typically the geology does not appear to be well reflected in the magnetic field. Certainly there are no northeast-trending linear anomalies within the northeast-trending marginal NeoArchean granodiorite (Agd) unit. Yet, within the broad west-northwest-trending unit of NeoArchean paragneiss, migmatite, metatexite, and diatexite (Adx) small NeoArchean units of porphyritic granodiorite (Akg), monzogranite to granodiorite (Ags) and gabbro and diorite (Adg) are associated with positive magnetic responses, with linear examples trending roughly west-northwest to west. These highs are not very extensive, not always aligned and vary somewhat in trend, and hence a strong linear pattern is not developed.

The southwest corner of the eastern segment of the domain is underlain mainly by NeoArchean monzogranite to granodiorite (Ags), within which are several roughly northeast-trending belt-like and fairly well separated geological units. A centrally located (east-west sense) extensive unit of mafic and minor felsic volcanic rocks interbedded with iron formation, mafic tuffs, pelitic metasedimentary rocks, and felsic pyroclastic rocks of the Committee Bay and Woodburn groups (ACWmv) (Skulski et al., 2018) trending predominantly northeast correlates with a distinct negative RTMF signature. However, at its north end a contiguous narrow, short unit of NeoArchean komatiite, komatiitic basalt and related ultramafic intrusive rocks (ACWk) belonging to the same groups correlates with a very strong positive linear high. The same rocks occurring in a narrower north-northeast-trending unit located several kilometres south of the main belt of mafic and minor felsic rocks (ACWmv) are also associated with a distinct linear high, but of significantly lower amplitude and very slightly displaced to the west.

West of the central unit of NeoArchean mafic and minor felsic volcanic rocks (ACWmv) the geology is dominated by alternating narrow to moderately wide, roughly east-northeast-trending belts of NeoArchean monzogranite to granodiorite (Ags) and NeoArchean K-feldspar porphyritic granodiorite of the Snow Island Suite (Akg). The latter unit also forms much of the southwestern margin of the domain in this area. Generally, this unit (Akg) tends to be associated with a relatively negative RTMF signature and the monzogranite to granodiorite unit (Ags) with a relatively positive signature. The signatures are distinct, but not very strong and some exhibit the roughly east-northeast trends of the geological units.

East of the central volcanic unit (ACWmv) the geology is dominated by generally east-northeast-trending alternating belts of NeoArchean monzogranite to granodiorite (Ags) and NeoArchean tonalite and quartz diorite (Ato). Neither of these units seems to be clearly reflected in the RTMF, and any reflection of the east-northeast geological trend is not readily apparent. Near the southeastern boundary of the domain a series of 5 narrow geological units consisting of mafic and minor felsic volcanic rocks (ACWmv) and of komatiite, komatiitic basalt, and related ultramafic intrusive rocks (ACWk) of the NeoArchean Committee Bay and Woodburn groups trends east-northeastward in a roughly linear arrangement for about 40 km. A single occurrence of iron formation within these rocks is mapped (Skulski et al., 2018). The middle geological unit of the series is by far the most extensive and features distinct moderate folding, and associated distinct magnetic highs, one of which is partially coincident with the iron formation. Two of the larger other units also display a positive magnetic signature, although weak in one case.

Although a suggested linkage between the western and eastern sectors of the domain has been proposed on the basis of a possible continuation of trends in the narrow connecting zone near the northern boundary, the contrast in the linear patterns observed in the western segment with the lack of a well-defined linear pattern in the eastern segment could be considered evidence to regard the separate segments as domains in their own right.

Domain 63 (Figures 11, 12): Domain 63 is a very small domain between Domains 62 and 64 that touches on the southern termination of Pelly Bay. It is defined as a domain because of the strong differences in patterns of linear derivative magnetic highs across the domain boundaries. In Domain 64 a strong northeast-trending pattern of linear highs runs parallel to the boundary with Domain 63, and a similar picture obtains for the northern marginal area of Domain 62 characterized by generally east-northeast-trending, sub-parallel magnetic highs. In Domain 63 trends of linear magnetic highs are variable, and highs are typically less extensive. Although trends are variable, there is apparently a preference for northwest trends, though locally such trends are related to northwest-trending NeoProterozoic Franklin diabase gabbro dykes (PF) (Skulski et al., 2018).

Most of the southwestern two-thirds of the domain is underlain by NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg). Small areas of NeoArchean porphyritic granodiorite ± hornblende ± magnetite of the suite (Akg) found within this "background" geological unit produce some moderate magnetic responses in the form of oval or short linear highs. Some areas of the monzogranite and granite pegmatite (Amg) also produce a similar, but less strong magnetic response, particularly in the northeast corner of the unit. Part of a very narrow unit of NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx) trending approximately northwest is also associated with a distinct curvilinear RTMF high. The magnetic field over of the rest of the southern two-thirds of the domain lies generally at background levels, but does contain very small, in amplitude and horizontal dimensions, scattered positive perturbations that relate mainly to the "background" unit of NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg).

The northeastern third of the domain is underlain predominantly by NeoArchean granodiorite of the Snow Island Suite (Agd). Several narrow, sub-parallel linear and curvilinear RTMF highs and small oval-shaped highs of small to moderate amplitude are observed within the northwestern corner and southwestern margin of this unit. The linear/curvilinear examples possibly outline compositional changes or layering within the unit controlled by local structures, and most of these trend between roughly west-northwest and north-northwest, across the overall trend of the domain. A narrow southwest-directed protrusion from the south end of the granodiorite unit (Agd) is also associated with a moderately strong linear high and very small (spatially) circular magnetic high, peak value 675 nT.

Domain 64 (Figures 11, 12): Domain 64 is a fairly broad domain, median width of about 75 km, running east-northeast across the southern end of the Boothia Peninsula. The domain is differentiated from Domains 62 and 63 to the south by its much tighter pattern of linear derivative magnetic highs, and from Domains 65 and 66 to the north by a general noticeable difference in the amplitudes of first vertical derivative linear magnetic highs, and in certain localities by differences in orientation of linear derivative anomalies.

With the exception of several linear RTMF magnetic highs related to Palaeoproterozoic Pelly Bay dykes (PP), Mesoproterozoic Mackenzie dykes (PMd) and Neoproterozoic Franklin dykes (PF) (Skulski et al., 2018), most linear magnetic highs in the domain are not very extensive. The Pelly Bay dykes (PP) are in part interpreted from aeromagnetic data (Skulski et al., 2018) and trend typically between roughly east and east-northeast. Mackenzie dykes (PMd) trend northwestward and Franklin dykes (PF) between about northwest and north-northwest.

Linear magnetic highs unrelated to dykes characteristically trend roughly east-northeast, though other trends are also present. Some short linear highs are collinear and separated by a small distance. It is likely that they reflect a single unit that has been transected by faulting. Many faults have been interpreted from the aeromagnetic data and some of these are responsible for the dissection of linear anomalies. Interpreted faults have orientations that are generally roughly north-northwest or west-southwest. In spite of the short extent of linear highs, and the general absence of trends other than the characteristic east-northeast trend, when the highs are considered together with the more extensive trends of Pelly Bay dyke (PP) anomalies and linear magnetic lows related to probable faults, some very extensive, a picture of a strongly developed east-northeast magnetic grain for the domain emerges. This most likely reflects the structural grain.

The RTMF is moderately strong across the domain with a superposed linear texture reflecting the aforementioned linear derivative magnetic highs. A noteworthy RTMF feature within the domain, close to the boundary with Domain 63, is an elongate elliptical area of strong positive magnetic field that includes an outer curvilinear high and internal sub-parallel highs that have a slightly anomalous northeast trend. Collectively they suggest large scale folding, and indeed this is substantiated by the mapped geology (Skulski et al., 2018). A central core of NeoArchean granodiorite of the Snow Island Suite (Agd) is completely surrounded by an approximately elliptically-shaped ring of NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg), in turn partially surrounded by a narrow band of NeoArchean tonalite gneiss (Atgn). This assembly of units is then successively surrounded by elliptically-shaped rings of the granodiorite (Agd) and the K-feldspar porphyritic granodiorite ± hornblende ± magnetite (Akg), with the latter being almost completely surrounded by NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg). The pattern of units suggests the presence of a synformal or antiformal structure.

The geology of the domain is characterized generally by belt-like units of moderate width, typically ranging from a few kilometres up to about 30 km, and with a predominantly east-northeast trend. These belts have little apparent influence on the magnetic field signatures. The RTMF displays a general positive signature interspersed with small areas of background magnetic field levels, and has a perturbed karst-like appearance. The RTMF over units or parts of units of NeoArchean K-feldspar porphyritic granodiorite ± hornblende ± magnetite of the Snow Island Suite (Akg) that cover roughly half of the domain are generally discernibly slightly higher than over units of monzogranite and granite pegmatite (Amg) and granodiorite (Agd) of the suite, which together cover a significant area of the domain. However, changes in the field at boundaries between these units are not striking, so that mapping these units using the magnetic field could be challenging.

Of some interest as possible economic targets are dimensionally small circular to oval-shaped RTMF highs, sometimes arranged in a linear bead-like pattern, within narrow units of NeoArchean mafic and minor felsic volcanic rocks of the Committee Bay and Woodburn groups (ACWmv) near the southern margin of the western part of the domain. In the main unit, approximately 40 km long, circular highs range from about 900 m to 1500 m in diameter and have amplitudes above background ranging from roughly 400 nT to 1450 nT. A much shorter mafic and minor felsic volcanic unit (ACWmv) (~8.5 km long) is associated with an oval magnetic high roughly 3000 m by 1750 m having an amplitude of about 1200 nT. The volcanic rocks of these units are interbedded with iron formation, mafic tuffs, pelitic metasedimentary rocks, and felsic pyroclastic rocks. It is speculated that these highs are related to iron formation.

Domain 65 (Figures 11, 12): Domain 65 is an elongate triangular domain extending southwestward from islands within the eastern waters of Pelly Bay to the Boothia Peninsula, terminating roughly half way across the peninsula. It is distinguished from Domain 64 to the south by its generally stronger and more continuous RTMF, and also locally by differences in the magnetic fabric and orientation of linear derivative magnetic highs. It is clearly differentiated from Domain 66 to the north, which displays a uniform pattern of sub-parallel, generally northeast-trending linear derivative highs. Generally, these highs are not very extensive, but certain series of collinear highs may be quite extensive. In contrast, linear derivative anomalies within Domain 65 are rarely oriented northeastward, are diverse in orientation and fairly often are not parallel to the boundary with Domain 66.

Domain 65 is underlain almost exclusively by NeoArchean mixed gneiss (Amgn) (Skulski et al., 2018) that includes amphibolite gneiss, hornblende-biotite gneiss, granitoid gneiss and migmatite, and which in part is derived from sedimentary and volcanic rocks. Given the presence of this unit on the outer islands of Pelly Bay it is predicted that it also underlies the waters of the bay. Within this tract of mixed gneiss on the mainland are three elongate, roughly elliptical-shaped rings of NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx). The largest, in the central southwestern part of the domain, is relatively broad and is cored mainly by the mixed gneiss (Amgn) with a very small oval unit of mafic and minor felsic volcanic rocks of the NeoArchean Committee Bay and Woodburn groups (ACWmv) near its centre. The latter unit and the elliptical ring of paragneiss (Adx) produce essentially negative signatures in the derivative magnetic maps, but the central mixed gneiss (Amgn) and exterior surrounding mixed gneiss produce very strong magnetic responses. Peak values for the RTMF for these areas range from about 500 nT to more than 1700 nT. Just south of this large ring, along the southern boundary of the domain, a smaller ring of NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx) enclosing NeoArchean monzogranite and granite pegmatite of the Snow Island suite (Amg) is again associated mainly with a negative magnetic signature, though a roughly elliptical, narrow magnetic high following the boundary between (Adx) and (Amg) migrates into (Adx) in places. The small core of NeoArchean monzogranite and granite pegmatite (Amg) correlates with a weak negative magnetic signature.

A stark contrast in signature is exhibited by a second extensive, but narrower, elliptical ring of paragneiss, migmatite, metatexite and diatexite (Adx) immediately northeast of the first ring and cored by mainly metasedimentary Palaeoproterozoic cover sequence of the Amer, Chantrey, Penrhyn and Ketyet River groups (Ps½). Together these rock units produce a prominent magnetic low in the RTMF image that continues eastward to cover a small, roughly elliptical-shaped unit of NeoArchean paragneiss (Adx) that terminates at the coast, and an adjacent short, very narrow unit of NeoArchean K-feldspar porphyritic granodiorite (Akg). A belt-like unit of NeoArchean paragneiss, migmatite, metatexite, and diatexite (Adx) along the northern margin of the domain near the coast is associated with a moderately positive RTMF response (peak values ~100 - 470 nT). Noticeably, NeoArchean mixed gneiss (Amgn) lying between this unit and the aforementioned magnetic low coincides with a much stronger RTMF response with peak values commonly in the range from about 500 nT to 900 nT.

Offshore, a narrow belt of high RTMF runs southeastward from the northern boundary of the domain passing through some of the outer islands of Pelly Bay. Peak values range generally from about 500 nT to 1000 nT, exceptionally attaining >2300 nT. The linear nature of this conspicuous belt of positive anomaly and its anomalous trend within the domain suggest that its source is controlled by block faulting.

Domain 66 (Figures 11, 12): Domain 66 is distinguished from adjacent domains by its prevailing strong linear pattern of sub-parallel, northeast-trending, narrow derivative magnetic highs, absent in Domain 67 to the north and Domain 64 to the south, and largely absent in Domain 65 to the south. The southwestern third of the domain is narrower with a nominal width of about 15 km and strikes approximately east-northeast in harmony with associated linear magnetic highs. The domain widens dramatically to the northeast where roughly two-thirds of the domain has a fairly uniform width of about 40 km. This segment strikes northeast, as do associated linear magnetic highs.

The southeastern margin of the wider part of the domain is underlain by NeoArchean mixed gneiss (Amgn) (Skulski et al., 2018) that includes amphibolite, hornblende-biotite and granitoid gneiss and migmatite, and is in part derived from sedimentary and volcanic rocks. This marginal strip, of varying width, runs from the islands of Pelly Bay southwestward until it disappears under Ordovician-Silurian limestone (OSc) that covers the on-land section of the narrower southwestern section of the domain. The strip displays generally a strong response in the RTMF and the characteristic pattern of sub-parallel, narrow linear magnetic highs in the derivative images. This generality breaks down southeast of Lady Melville Lake, where the strip broadens significantly to more than half the width of the domain. In this area some short alternating narrow belts of positive and negative response in the RTMF are present, but the northeast linear fabric is not everywhere well developed, and loosely clustered, spatially small, globular magnetic highs dominate some small areas. Some small east-northeast- to northeast-trending enclaves within the mixed gneiss unit (Amgn) formed of NeoArchean gabbro and diorite (Adg) or of mainly metasedimentary Palaeoproterozoic cover sequence (Ps3, Ps½) correlate with negative anomalies in the RTMF image. The strong RTMF signature over the narrow southwestern portion of the domain suggests that NeoArchean mixed gneiss (Amgn) continues to the west-southwest under Ordovician-Silurian sedimentary cover (OSc) and the waters of Rasmussen Basin.

The northwestern margin of the domain is underlain by four northeast-trending, sub-parallel geological units. Successively, from the northwestern boundary, these are formed of (1) Archean-Proterozoic mixed gneisses with layered orthogneiss, biotite-quartz-feldspar gneiss, paragneiss (and migmatite), diatexite, and mafic gneiss of sedimentary and volcanic origin (APgn), (2) NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx), (3) NeoArchean orthopyroxene-granite/granodiorite (Agc), and (4) another belt of NeoArchean paragneiss (Adx). The belt of orthopyroxene-granite/granodiorite (Agc) is conspicuous by its very strong RTMF signature and density and continuity of linear derivative magnetic highs. The strong signature seemingly continues through Lady Melville Lake to the southwestern shore of the lake where the ground is mapped as Archean-Proterozoic mixed gneisses (APgn). This magnetic evidence strongly suggests that this area south of the lake is probably underlain by NeoArchean orthopyroxene-granite/granodiorite (Agc). The signature of the orthopyroxene-granite/granodiorite unit is flanked either side by a RTMF over the NeoArchean paragneiss (Adx) belts that is noticeably more negative, though including some distinct narrow linear highs. The narrow northwestern marginal belt of Archean-Proterozoic mixed gneisses (APgn) has a RTMF signature not unlike those over the paragneiss units with noticeable narrow, sub-parallel linear highs and lows.

Domain 67 (Figures 11, 12): Domain 67 is distinguished from Domain 66 by its relatively poorly developed northeast-trending linear fabric in derivative magnetic images compared to that which is so well developed in Domain 66. Northeast-trending RTMF highs are present within Domain 67, but are rarely grouped in sub-parallel fashion and tend to be scattered. When viewed along with highs having various other trends, and considering that some highs are interrupted by narrow linear magnetic lows, the pattern of linear derivative features appears somewhat disorganized in some areas. Nevertheless, there is a sense of a northeast-trending attribute, particularly in the southwestern half of the domain where Ordovician-Silurian sedimentary cover (OSc) is present. Here, derivative linear anomalies are more extensive and seemingly less disturbed by faulting. They are also broader, presumably as a result of burial beneath cover. The domain itself has a northeast trend, and areas of magnetic high in the RTMF, though sometimes irregular in shape, generally have their longest dimension oriented northeast.

Differentiating Domain 67 from Domain 68 was challenging. The RTMF characteristics either side of the boundary are similar, so definition of the boundary was based on images of the derivative magnetic anomalies. Near the southwestern and northeastern ends of the boundary, differences in trends of linear anomalies allowed a more certain placement of the boundary, and at the extreme northeast end of Domain 67 the edge of a prominent RTMF high was used to define the boundary. Elsewhere definition was based on subtle changes in the texture of the derivative images.

Except for a small area of NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg) located on the coast of the Gulf of Boothia, the northeastern half of the domain is underlain exclusively by Archean-Proterozoic mixed gneisses with layered orthogneiss, biotite-quartz-feldspar gneiss, paragneiss (and migmatite), diatexite and mafic gneiss of sedimentary and volcanic origin (APgn). The southwestern half is covered by Ordovician-Silurian limestone (OSc) (Skulski et al., 2018). The RTMF displays several relatively strong, elongate, roughly oval-shaped magnetic highs of moderate spatial dimensions having a general northeast trend throughout the domain. Many comprise shorter wavelength linear anomalies, more clearly viewed in the derivative magnetic images. These oval areas of magnetic highs are juxtaposed everywhere with irregular areas of magnetic high, and collectively the various highs produce the dominantly positive magnetic signature of the domain.

Magnetic highs are comparatively smoother in the area of Ordovician-Silurian limestone (OSc), producing an image that contrasts with the rougher, karst-like appearance of the RTMF over exposed Precambrian rocks in the northeastern half of the domain. Considering that the domain is almost entirely underlain by a single geological unit, Archean-Proterozoic mixed gneisses (APgn), it is not possible to attribute the various magnetic anomalies in different areas to specific rock-types. However, the unit does include a variety of rock-types, as previously described, and therefore the magnetic anomalies presumably reflect this diversity within the overall unit.

Domain 68 (Figures 11, 12): Domain 68 is defined on its curious heterogeneity of RTMF pattern that includes somewhat moderately large, irregularly-shaped areas of magnetic high displaying a variety of superposed rough, karst-like textures interspersed with moderately large areas of magnetic lows that are generally featureless apart from very narrow linear highs undoubtedly related to dykes. These dyke anomalies trend variously northwestward, north-northwestward, north-northeastward and northward. Correlative dykes are not displayed on the geological map by Harrison et al. (2015). The "rough" textures are observed in approximately the eastern two-thirds of the domain underlain largely by Palaeoproterozoic and Archean crystalline rocks (Harrison et al., 2015; Skulski et al., 2018), whereas in the western third covered by Cambrian through Silurian sedimentary rocks (Harrison et al., 2015) the principal highs are smooth, consequent on presumed burial of sources within the underlying Precambrian rocks.

Narrow linear RTMF highs are observed throughout the domain, either as isolated individual anomalies or superposed in company with similar anomalies on larger areas of positive magnetic signature. The prevailing trends of the highs are generally between roughly north-northeast and E10^{O}N, though some ranging from approximately northward to northwestward are also observed.

The southeastern margin of the domain is underlain by Archean-Proterozoic mixed gneisses with layered orthogneiss, biotite-quartz-feldspar gneiss, paragneiss (and migmatite), diatexite and mafic gneiss of sedimentary and volcanic origin (APgn) (Skulski et al., 2018), which are associated with a series of linear RTMF highs. These presumably reflect structural trends and compositional changes within the various gneisses. They trend roughly northeast along the greater part of the margin, but swing east-northeast at the northeast end. Some distinct narrow magnetic lows having similar orientations are also observed. Where more than one linear high is present within the marginal area, highs are sub-parallel.

North of the southeast marginal area, in the northeast corner of the domain northeast of a prominent northwest-trending fault bounding a broad belt of Cambrian-Silurian sedimentary rocks (CmO1, CmSa) to the southwest (Harrison et al., 2015), the domain is underlain principally by units of Archean-Palaeoproterozoic granite (ApPbc4) and orthopyroxene granitoid gneiss-paragneiss (ApPbc2), and some smaller units of Palaeoproterozoic pelitic gneiss (mainly) (pPb1) (Harrison et al., 2015). This area is dominated by moderately large areas of positive RTMF whose longest dimensions tend to have a northeast orientation. The greater part of each of these areas correlates with the Archean-Palaeoproterozoic granite (ApPbc4), but these magnetic highs are also associated with the other two aforementioned units, sometimes traversing a boundary between units. It is, therefore, difficult to characterize these geological units in terms of a specific magnetic signature. A noteworthy feature of the magnetic field in this area is a prominent magnetic low striking southwest through the centre of the northeast corner of the domain, traversing all three Precambrian units and the fault bounding the Cambrian-Silurian belt, and linking with another prominent low within the belt. A seemingly logical explanation for the low is that it is related to a fairly thick development of unmapped Cambrian-Silurian sedimentary rocks. This proposal is negated, however, by the fact that the low crosses a boundary between Archean-Palaeoproterozoic granite (ApPbc4) and orthopyroxene granitoid gneiss-paragneiss (ApPbc2) that is locally very irregular. This suggests that in defining the boundary outcrops on both units were examined and identified to be Precambrian thus ruling out the possible presence of Cambrian-Silurian rocks.

The Cambrian-Silurian sedimentary rocks (CmO1, CmSa) in the broad belt in the central part of the domain fall within three separate sub-belts. All are terminated to the northwest by Precambrian rocks along a fairly straight, northeast-trending contact, a short portion of which is represented by a fault (Harrison et al., 2015). These Precambrian rocks belong to a unit formed mainly of Palaeoproterozoic pelitic gneiss with lesser carbonate, calcsilicate, quartzite, othopyroxene granitoid gneiss and some metamorphosed supracrustal rocks (pPb1), and a unit of Archean and Proterozoic orthopyroxene granitoid gneiss-paragneiss (ApPbc2). Approximately half of the largest Cambrian-Silurian sub-belt in the northeast displays a positive RTMF signature similar to signatures over Precambrian rocks. The other half is characterized by fairly intense negative signatures compatible with a thick succession of sedimentary rocks. The positive magnetic components of the sub-belt are attributed to areas where the sedimentary cover is extremely thin or possibly absent.

The smaller adjacent sub-belt of Palaeozoic rocks immediately to the southwest, partially separated from the larger sub-belt by a fault and small units of Precambrian rocks, is characterized by a predominantly positive RTMF signature, again attributed to a very thin development of Palaeozoic sedimentary rocks. The final, very small sub-belt, better described as a moderately large oval-shaped unit of Palaeozoic sedimentary rocks, is almost entirely associated with a distinct magnetic low that extends well to the east and south of the unit, questioning the mapping of Precambrian rocks in those areas. Southward from this low to the shores of the St. Roch Basin units of Archean-Palaeoproterozoic granite (ApPbc4) and orthopyroxene granitoid gneiss-paragneiss (ApPbc2) are associated with positive magnetic signatures typical of these units elsewhere in the domain.

The magnetic signature of Precambrian rocks northwest of the broad central belt of Palaeozoic sedimentary rocks is noticeably different from that over Precambrian rocks elsewhere in the domain. Here, a strong linear pattern of narrow sub-parallel RTMF magnetic highs that collectively form a moderately broad band of magnetic high runs approximately N30°E for about 90 km. It correlates mainly with Palaeoproterozoic pelitic gneiss (mainly) (pPb1), but crosses boundaries with Archean-Palaeoproterozoic orthopyroxene granitoid gneiss and paragneiss (ApPbc2), questioning the distribution of these rocks as displayed on the map by Harrison et al. (2015). Northwest of this linear magnetic belt a shorter sub-parallel, hook-shaped linear belt comprising several narrow highs runs south-southwestward through the centre of a large unit of the orthopyroxene granitoid gneiss and paragneiss (ApPbc2) crossing its boundary into a unit of Palaeoproterozoic pelitic gneiss (mainly) (pPb1) before terminating. These relationships once again question the distribution of these two units as mapped (Harrison et al., 2015). The hook-shaped pattern at the south end of the belt possibly reflects fairly tight folding.

In the western part of the domain covered by Cambrian-Silurian sedimentary rocks (Scs, CmSa, CmO1), RTMF anomalies are very smooth, testifying to a significant depth of burial of probable sources within underlying Precambrian rocks. Along the western coastal area a moderately wide belt of RTMF high trends northward, contrasting with the roughly northeast trend of a similar belt in the southeast corner of the area of cover. In the V-shaped area between these two principal highs, narrower highs trend both east-west and northeast. This diversity in trend of magnetic anomalies suggests the presence of major structural breaks in the Precambrian basement.

Domain 69 (Figures 13, 14): Domain 69 is an extensive belt-like domain running northeast for about 590 km from near the centre of the main Thelon basin to the eastern coast of the Adelaide Peninsula. Outside the basin it is defined principally by a strong positive RTMF signature, characterized by several parallel to sub-parallel narrow linear magnetic highs, which contrasts strongly with the subdued magnetic expressions of the flanking domains. The linear RTMF highs produce a strong pattern in the derivative maps with many highs being quite extensive and closely packed, in strong contrast to the looser patterns of linear highs in adjacent domains. The occurrence of a partially defined, prominent RTMF high in Rassmussen Basin along strike from Domain 69 and also on strike with Domain 67 to the northeast on Boothia Peninsula (Fig. 11), suggests a possible link between these two domains.

Significantly, the eastern boundary of the domain lies very close to the Chantrey fault zone (Skulski et al., 2018), being coincident or near-coincident over about 100 km near the northeast end of the boundary. Elsewhere it lies no more than 8 km from the fault zone and to the east. NeoArchean mixed gneiss that includes amphibolite gneiss, hornblende-biotite gneiss, granitoid gneiss and migmatite, in part derived from sedimentary and volcanic rocks (Amgn) (Skulski et al., 2018), covers most of the domain north of the Thelon basin and is generally associated with moderately strong to strong positive magnetic signatures, though two northeast-trending belts of neutral magnetic field are present immediately north of the Thelon basin. The mixed gneiss unit (Amgn), apart from the presence of a relatively small unit of NeoArchean granitoid rocks (Agu) near the north end of the domain, runs the entire length of domain between the Thelon basin and

Ordovician-Silurian sedimentary cover (OSB) on Adelaide Peninsula, generally occupying all or at least half of the width of the domain.

Along the northwestern boundary of the domain two elongate, northeast-trending units belonging to the Archean-Proterozoic Queen Maud Granitoid Belt also produce strong RTMF signatures. That near the north end of the domain is formed mainly of massive to gneissic orthopyroxene-granite and orthopyroxene-granodiorite (APQg), and the other, more centrally located (north-south sense) within the domain, comprises gneissic granite, granodiorite and quartz diorite (APQgn) (Skulski et al., 2018).

Roughly the eastern half of the domain for about 95 km northeast of the Thelon basin is underlain by a unit of NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg). North of this unit the belt of NeoArchean mixed gneiss (Amgn) includes several relatively small units of NeoArchean undifferentiated granitoid rocks (Agu) and NeoArchean paragneiss, migmatite, metatexite and diatexite (Adx), but these units apparently have little influence on the magnetic signature. The linear derivative magnetic highs that typify the NeoArchean mixed gneiss (Amgn) generally continue through such units with little interruption, though there is hint of fragmentation or disruption of some highs. It is speculated that the continuation of highs and minor modifications indicate that these units are relatively thin. Apparent continuity of some linear highs from the unit of mixed gneisses (Amgn) into the large unit of NeoArchean monzogranite and granite pegmatite (Amg) along the eastern margin of the domain likewise may indicate that the latter unit is also relatively thin and weakly magnetic, if indeed it overlies (Amgn).

The characteristic linear derivative magnetic pattern of the northeastern half of the domain is absent over the Thelon basin, though prominent RTMF highs lie along much of the western margin along strike from the belt of NeoArchean mixed gneiss (Amgn). The highs are smooth, consistent with burial of sources beneath the Thelon basin sedimentary rocks. Favoured candidates for sources are relatively magnetic portions of NeoArchean mixed gneiss (Amgn) and granitoid plutons belonging to the NeoArchean Snow Island Suite (Amg, Akg, Agd). Tschirhart et al. (2017) had proposed such plutons as potential sources for similar magnetic highs within and near the neighbouring Aberdeen sub-basin.

The eastern marginal area and southwestern extremity of Domain 69 within the Thelon basin is characterized by a magnetic field at background level or even relatively negative that is quite smooth. The main perturbations of the field in this area are related to very narrow northwest-trending Mackenzie dykes (PMd) (Pehrsson et al., 2014a,b; Skulski et al., 2018). The source(s) of the quiet zones is uncertain. It has been proposed that linear magnetic highs characteristic of the NeoArchean mixed gneiss (Amgn) may traverse the large unit of NeoArchean monzogranite and granite pegmatite of the Snow Island Suite (Amg) along the eastern margin of the domain, indicating the presence of mixed gneiss (Amgn) buried beneath a unit (Amg) that is relatively thin and weakly magnetic. If this were the case and the unit of monzogranite and granite pegmatite (Amg) continues southwestward and thickens under the Thelon basin its weak magnetization could influence the magnetic field to produce a relatively negative magnetic signature in this area. The short boundary between Domain 69 and Domain 6 is drawn along the edge of a narrow northeast-trending linear magnetic high assigned to the latter domain. While not a strong criterion on which to base a domain boundary, the overall low level of the magnetic field within Domain 6 is generally perturbed by small (dimensionally and in amplitude) magnetic highs, which are not observed in Domain 69.

Domain 70 (Figures 13, 14): Domain 70 is an elongate wedge-shaped domain attaining a width of about 60 km at the coast near the Sherman Basin, and extending southwestward across the Archean-Proterozoic Queen Maud Granitoid Belt (Skulski et al., 2018) for about 300 km to the tip of the wedge. The central part of its eastern boundary is near-coincident with the eastern boundary of the granitoid belt, but some geological units or parts thereof assigned to the belt are located along the boundary within Domain 69. Their inclusion within Domain 69 is based on their associated positive RTMF signatures, which contrast with the dominantly weak magnetic signature of Domain 70. Two of the granitoid belt units exhibit strong positive signatures (described in Domain 69), whereas a third unit has a weak positive signature and covers a limited area within Domain 69 near the southern end of Domain 70. It is composed of Archean-Proterozoic mixed gneisses with layered orthogneiss, granitoids, paragneiss (and migmatite), diatexite and mafic gneiss of sedimentary and volcanic origin (APQmg). Virtually the same area outlined for Domain 70 was delineated on an aeromagnetic map as the "Sherman Basin" by Davis et al. (2014), who noted the basin to be defined by a pronounced magnetic low associated with the sedimentary rocks of the Palaeoproterozoic Sherman Group.

The Sherman Group is the dominant, and youngest, geological unit in the domain, comprising mainly granulite grade, migmatized pelitic and semipelitic metasedimentary rocks with garnet-bearing melt leucosome (PSgp) (Skulski et al., 2018). These rocks stretch across the width of the domain near the coast, cover much of the eastern margin at and immediately south of McNaughton Lake, and cover much of the width, excepting the tip of the wedge, further south. Most of the remainder of the domain, particularly near the lake and along the western margin, is underlain by Archean-Proterozoic granulite grade mixed gneiss with layered orthogneiss, orthopyroxene-bearing granitoids, diatexite, and mafic gneiss of sedimentary and volcanic origin (APQgm). A few small areas of Archean-Proterozoic massive to gneissic orthopyroxene-granite and orthopyroxene-granodiorite with minor orthopyroxene tonalite, norite and high grade paragneiss (APQg) are also present.

The entire length of approximately the western two-thirds of Domain 70 is characterized by narrow linear magnetic highs, present within all of the aforementioned geological units. In contrast, much of the eastern third is characterized by a weak RTMF that also extends across all three geological units. The area of weak field is generally little-affected by perturbations, though some weak northeast-trending linear highs, more evident in the linear derivative images, are discernible near the north end of the domain. It is presumed that where the western linear highs fall on the two geological units (APQgm, APQg) belonging to the Queen Maud Granitoid Belt their sources are directly within the units and related to compositional variations within the gneissic rocks.

The sources of the linear magnetic highs over the granulite grade, metasedimentary rocks of the Sherman Group (PSgp) are more problematical, considering how this magnetic pattern contrasts strongly with the dominant relatively negative and smooth magnetic field associated with the group in the east. Possibly, the highs reflect sources within the Sherman Group, which comprises a variety of rock-types that includes the principal granulite grade pelitic and semipelitic metasedimentary rocks with garnet-bearing melt leucosome, and minor mafic gneiss, calc-silicate and granitic gneiss. On the other hand, if the Sherman Group is thin and weakly magnetic along the western two-thirds of the domain, the linear highs could be linked to compositional layering within underlying gneiss-bearing geological units (APQgm, APQg) of the Queen Maud Granitoid Belt, though some of both units, or portions thereof, do not display prominent internal linear magnetic highs.

The belt of subdued RTMF along the eastern margin of the domain is associated variably with all three of the principal geological units (PSgp, APQgm, APQg) within the domain. The development of weak, short linear or globular magnetic highs is also observed in all three units, though not everywhere so prevalent in the Sherman Group. The occurrence of a relatively negative and positive RTMF on the eastern and western margins of the domain, respectively, apparently indicates larger scale variations in the composition of the unit of granulite grade mixed gneiss with layered orthogneiss, orthopyroxene-bearing granitoids, diatexite, and mafic gneiss of sedimentary and volcanic origin (APQgm) and unit of mainly massive to gneissic orthopyroxene-granite and orthopyroxene-granodiorite (APQg). It is possible also that the eastern relatively negative signature signifies that the Sherman Group (PSgp) is weakly magnetic and/or thicker in this area.

Domain 71 (Figures 13, 14): Domain 71 is characterized by a strong positive RTMF signature that contrasts with the generally subdued signature of Domain 70 and more variable signature of Domain 72. The western boundary with Domain 72 was also influenced by differences in the textures of derivative magnetic anomaly patterns and trends of linear magnetic highs to either side. The domain is roughly wedge-shaped, about 370 km long, and trends roughly north-northeast. For about 70 km south-southwestward from the coast it has a nominal width of about 110 km before tapering rapidly over the next 80 km, and then gradually to its south end.

In the north the domain is characterized by a dominantly strongly positive RTMF response, with distinct areas of positive anomaly to either side separated by a central, narrower north- to north-northeast-trending dominantly negative response. One could argue that the domain should be subdivided in this area to recognize these variations, but at the current scale of investigation it was decided to maintain a single entity. The rationale for doing so is the dominance of north-northwest- to north-northeast-trending narrow and closely spaced derivative linear magnetic highs across this portion of the domain.

The eastern half of the domain, from the coast to just within the narrow southern tip of the domain, is underlain principally by Archean-Proterozoic granulite grade mixed gneiss with layered orthogneiss, orthopyroxene-bearing granitoids, diatexite and mafic gneiss of sedimentary and volcanic origin (APQgm) of the Queen Maud Granitoid Belt. Also present, are small, but significant, patches of Palaeoproterozoic Sherman Group granulite grade metasedimentary rocks (PSgp), together with some larger units of Archean-Proterozoic mixed gneisses with layered orthogneiss, granitoids, paragneiss (and migmatite), diatexite and mafic gneiss of sedimentary and volcanic origin (APQmg) of the Queen Maud Granitoid Belt (Skulski et al., 2018).

The western half of the same portion of the domain is made up of roughly equal areas of Meso-NeoArchean mixed gneiss dominated by orthopyroxene-bearing granitic orthogneiss with variable amounts of metavolcanic and metasedimentary gneisses and migmatite (AMQgm), and Meso-NeoArchean granulite grade paragneiss, mafic gneiss (metavolcanic), with some mixed gneiss and granitic orthogneiss (AMQgp). A large unit of Meso-NeoArchean mixed gneiss dominated by granitic orthogneiss with variable amounts of discontinuous mafic (metavolcanic) and metasedimentary gneisses and migmatite (AMQmg) is present near the centre of the domain (east-west sense) juxtaposed with the equally large unit of Archean-Proterozoic mixed gneisses with layered orthogneiss, granitoids, paragneiss (and migmatite), diatexite and mafic gneiss of sedimentary and volcanic origin (APQmg) of the Queen Maud Granitoid Belt in the eastern half of the domain.

The boundary between the dominant Archean-Proterozoic granulite grade mixed gneiss (APQgm) of the eastern half of the domain and the Meso-NeoArchean mixed gneiss dominated by orthopyroxene-bearing granitic orthogneiss (AMQgm) of the western half remarkably falls along or very close to the western margin of the continuous positive magnetic belt in the eastern half of the domain. The apparent continuity of linear magnetic anomalies from the Archean-Proterozoic granulite grade mixed gneiss (APQgm) across boundaries into other units (principally APQmg and PSgp) in the derivative images in the eastern half of the domain suggests that this mixed gneiss is the principal source of the anomalies and that other units are thin and/or weakly magnetic and underlain by this gneiss. The continuous positive belt was used by Davis et al. (2014) to define what they termed "Queen Maud granitoid belt".

A relatively broad unit of Meso-NeoArchean mixed gneiss dominated by orthopyroxene-bearing granitic orthogneiss (AMQgm) extending southward from the coast in the central part of the domain is terminated by a southward-trending unit of similar width formed of Meso-NeoArchean mixed gneiss dominated by granitic orthogneiss (AMQmg) (Skulski et al., 2018). The latter unit gives way to the south to another unit of mixed gneiss (AMQgm) that extends south-southwestward for about 60 km. These three collinear units form a combined belt that is noticeably associated with a generally relatively negative RTMF signature that contrasts with strong positive signatures to either side, though narrow linear magnetic highs are present in some areas. The continuity of the three units, and the similarity in their rock-types with mixed gneiss dominated by some kind of granitic orthogneiss present in all, suggest possible gradational changes between the units. This may explain the pervasive negative signature.

The western margin of the domain is dominated by a unit of Meso-NeoArchean granulite grade paragneiss, mafic gneiss (metavolcanic), with some mixed gneiss and granitic orthogneiss (AMQgp), which in the north almost totally surrounds a large unit of Meso-NeoArchean mixed gneiss dominated by orthopyroxene-bearing granitic orthogneiss (AMQgm). Both of these units are associated with a strong RTMF response in the area of the latter unit and it is difficult to differentiate between their individual magnetic signatures, either in the RTMF or the derivative magnetic images. Farther north, in the area of the coast, the positive RTMF response is less continuous and takes the form of narrow linear magnetic highs interspersed with relatively negative linear lows that characteristically trend north to north-northeast. In the same area north-directed "fingers" of unit (AMQgp) alternate with narrow belts of unit (AMQgm), but the individual units do not display a strong correlation with the linear anomalies.

In the northern part of the domain, near the western boundary, the area of positive RTMF over and around the unit of Meso-NeoArchean mixed gneiss dominated by orthopyroxene-bearing granitic orthogneiss (AMQgm) is separated from a roughly 10 km wide, north-northeast-trending linear RTMF high along the eastern margin of the western half of the domain by a prominent, narrow northward-trending magnetic low that probably signifies a fault. The high traverses mainly a unit of Meso-NeoArchean granulite grade paragneiss, mafic gneiss (metavolcanic), with some mixed gneiss and granitic orthogneiss (AMQgp) that includes very small areas of Meso-NeoArchean mixed gneiss dominated by orthopyroxene-bearing granitic orthogneiss (AMQgm). It also passes through a roughly northward-trending, narrow Meso-NeoArchean unit composed mainly of plagioclase-hornblende and/or -biotite schist and gneiss, amphibolite (metavolcanic), garnetiferous schist and gneiss, and metamorphosed iron formation (AMQd). It is speculated that since this singular magnetic high apparently crosses the various geological units without significant modification at boundaries it might relate principally to the main unit with which it is associated, the unit of Meso-NeoArchean granulite grade paragneiss, mafic gneiss (metavolcanic), with some mixed gneiss and granitic orthogneiss (AMQgp). Other units may contribute to the high in their respective areas, or are possibly thin and weakly magnetic, permitting the signature of possibly underlying granulite grade paragneiss (AMQgp) to be observed.

The southern narrow tip of the domain is revealed as an area characterized by positive RTMF anomalies trending northeast to north-northeast along its length. Many are narrow, linear and sub-parallel, and are reflected in a strong pattern of linearity in the derivative magnetic images that contrasts strongly with patterns in flanking domains. This area is only partially covered by the map of Skulski et al. (2018) where it is underlain by Archean-Proterozoic mixed gneisses with layered orthogneiss, granitoids, paragneiss (and migmatite), diatexite and mafic gneiss of sedimentary and volcanic origin (APQmg) of the Queen Maud Granitoid Belt. Southwestward geological coverage is provided by a 1: 5 000 000 scale geological map of the Arctic (Harrison et al., 2011) and a 1:3 500 000 scale geological map of Nunavut (de Kemp et al., 2006), with the area being underlain essentially by a variety of NeoArchean gneisses and plutonic rocks. The extreme tip of the domain ends within the Thelon basin.

Domain 72 (Figures 13, 14): Domain 72 extends north-northeastward approximately 480 km from the vicinity of the McDonald Fault to Queen Maud Gulf maintaining a fairly constant width of about 40 ± 5 km and bowing gently eastward in the central part of its path. It is distinguished from adjacent domains by both its RTMF and derivative magnetic signatures. In contrast to Domain 71 to the east that presents a greater continuity of mainly north-northeast-trending, linear magnetic highs, Domain 72 displays a greater diversity in orientation of linear highs, which commonly intersect the mutual boundary at high angles, particularly within the central part of the domain (north-south sense). This truncation of trends within Domain 72 at high angles is observed also along the boundary with Domain 73 to the west in the same general area.

The domain is also defined by differences in the texture of the RTMF. The greater diversity in trends and preponderance of relatively small oval to circular highs, a somewhat uneven distribution of more extensive highs of various orientations and shapes, and a karst-like appearance in some areas, notably the northern end of the domain, combine to present a "disorganized" RTMF pattern, compared to the more regular pattern in Domain 71. In spite of this disarray, a chain of elongate, but irregularly-shaped, highs is present along the western margin of the domain, contrasting strongly with a generally subdued magnetic field in Domain 73 to the west. Placement of the boundary along the western edge of the chain was aided by the derivative magnetic images. Approximately the southernmost 160 km of the domain falls within the Thelon basin. Here, the chain of RTMF highs along the western margin is still evident, eventually filling the full width of the tip. The highs are smooth, consequent on burial of the presumed basement sources beneath the sedimentary cover.

On the exposed basement the northern third of the domain is dominated by Archean undivided granulite facies gneiss (Amgn) within which are some moderately large scattered bodies of Archean-Palaeoproterozoic granulite facies granitoids (APmgr) (de Kemp et al., 2006). Overlap of the map by de Kemp et al. (2006) with that of Skulski et al. (2018) to the east shows that the granulite facies gneiss (Amgn) is equivalent to Meso-NeoArchean mixed gneiss dominated by orthopyroxene-bearing granitic orthogneiss (AMQgm) on the latter map. A large area of Archean-Proterozoic granulite facies sedimentary and volcanic rocks (APmsv) lies along a substantial section of the eastern margin. These rocks are equivalent to Meso-NeoArchean granulite grade paragneiss, mafic gneiss (metavolcanic), with some mixed gneiss and granitic orthogneiss (AMQgp) as portrayed by Skulski et al. (2018). A moderately large body of

Archean-Proterozoic granite-monzonite-syenite (APgr) (de Kemp et al., 2006) lies near the southern contact of the Archean granulite facies undivided gneiss (Amgn) with Archean undivided gneiss (Agn) that makes up most of the southern portion of the domain outside of the Thelon basin. None of the aforementioned bodies, nor the boundary between the two types of Archean undivided gneiss, seem to influence the patterns of the magnetic field. The magnetic signatures in this northern portion of the domain are therefore attributed mainly to the Archean undivided granulite facies gneisses (Amgn), and the apparent lack of discernible change in signature at boundaries is attributed to one or more of the following factors: imprecise positioning of boundaries resulting from reconnaissance scale geological mapping; units within the granulite facies gneisses are thin; contacts between units are gradational; the units are weakly magnetic.

The exposed basement of the southern half of the domain is practically all Archean undivided gneiss (Agn) (de Kemp et al., 2006) and there are no clues relating to the sources of magnetic signatures, particularly with respect to the series of RTMF highs along the western margin, sources of which presumably continue southward under the sedimentary cover of the Thelon basin.

Domain 73 (Figures 13, 14): Domain 73 extends east-northeastward for about 420 km from the McDonald Fault before pinching out between Domains 72 and 74 roughly 65 km south of Queen Maud Gulf. The southern half is relatively narrow having a nominal width of about 11 km. The northern half is significantly wider and while narrowing at both ends it is generally between about 30 km and 40 km wide, bowing out westward near the centre (north-south sense) to about 60 km width. The domain is defined principally by its RTMF signature, which is relatively subdued in comparison to signatures of flanking domains, though there is some positive activity where the domain is widest, with superposed narrow linear highs in some areas.

In terms of derivative magnetic anomalies there is little activity in the narrow southern half of the domain with loosely scattered small globular highs and a few short linear highs providing the highlights. There is no discernible organized pattern, apart from 6 roughly northwest-trending very narrow linear highs that doubtless reflect Mackenzie dykes. The northern tip of the domain presents a similar picture of loosely concentrated scattered small globular highs and some short linear highs. Geologically, no detailed information is available. Practically the entire domain is underlain by Archean undivided gneiss (Agn) (de Kemp et al., 2006).

There is a relatively weak, but noticeable, development of a linear fabric where the domain is widest, opposite the marked protrusion to the west. Here, a series of sub-parallel, narrow, short to moderately extensive linear derivative magnetic highs define a belt some 15 km to 20 km wide running northward to north-northwestward along the eastern margin of the domain, before swinging gradually northwest as it crosses most of the domain. The belt is slightly concave towards the west. The lack of detailed geological information precludes attribution of this curvilinear magnetic belt to any particular rock-type or group of rock-types, but it may be inferred that the belt indicates a distinct group of gneissic rocks.

Within the western protrusion, a few short, narrow, positive RTMF highs run northward to northwestward parallel/sub-parallel to the western boundary. Between these highs and those of the curvilinear magnetic belt farther east, a few short highs trend roughly east-northeast to northeast in the centre (west-east sense) of the domain. Several generally roughly northward- to northwest-trending faults have been interpreted from the magnetic patterns in this area, along the divides between the various trends. This area of the domain near the western protrusion may be an area of some structural complexity. It is noted that a narrow north-trending belt of Archean-

Proterozoic sedimentary rocks (APs) (de Kemp et al., 2006) in the apex of the domain and another within the southern constricted portion of the domain are associated with distinct relatively negative areas of the RTMF.

Domain 74 (Figures 13, 14): Domain 74 is very extensive, trending northward to north-northeastward for about 490 km from the McDonald Fault to the Queen Maud Gulf. It attains a maximum width of just over 90 km near its centre and tapers gently northward towards the coast and more rapidly southward towards the McDonald Fault. It is defined principally by a RTMF pattern of belts of sub-parallel, narrow linear highs separated by intervening linear lows. Noticeable within the domain is a distinct continuous magnetic low extending from near the coast almost to the McDonald Fault, splitting into two separate lows just north of the fault. The low falls close to the western margin of the domain near the north end, then migrates towards the centre before curving back towards the western margin within the widest part of the domain and maintaining that position to the south end. It will be referred to herein as the "central low". Near the coast it is about 2 km to 3 km wide and of similar width or slightly wider near the McDonald Fault, but attains more than 6 km along much of its central path (north-south sense) and a maximum width of about 12 km. A heart-shaped RTMF low is present in the wide central portion of the domain near the eastern margin.

The pattern of RTMF anomalies of Domain 74 is clearly distinct from the more continuous, strong positive expression of Domain 75 to the west, and from the dominantly low magnetic field of Domain 73. It is also well defined by its pattern of narrow linear, sub-parallel derivative magnetic highs trending predominantly northward to north-northeastward, which contrast with a relative lack of linear highs in Domain 73, and generally northward to north-northwestward trends in Domain 75; linear highs in the latter domain also tend to be more concentrated than in Domain 74.

Geological coverage of the entire domain is provided by the compilation map at 1: 5 000 000 scale of Harrison et al. (2011), for most of the domain by the geological map of Nunavut (de Kemp et al., 2006), and for a central portion of the domain by a geological map compiled by Berman et al. (2015b) and based on interpretation of aeromagnetic data integrated with geological mapping from the 1980s, 2014 mapping observations, and geochronology and geochemistry acquired in 2015. The latter is more detailed and is used for the comparison with the aeromagnetic images presented here, notwithstanding that some aeromagnetic interpretation is incorporated. Berman et al. (2015c) used aeromagnetic data to subdivide an area corresponding closely to the relevant area of Domain 74 into 8 magnetic domains equated with crustal domains. Alternating relatively positive and negative areas of a RTMF map were delineated and interpreted variously as reflecting metaplutonic, plutonic or metasedimentary crustal domains. This interpretation has been incorporated into the geological map presented by Berman et al. (2015b).

Berman et al. (2015b,c) reported that belts of RTMF high reflect metaplutonic or metasedimentary units, whereas the extensive northward-trending central low traversing western and central portions of Domain 74, the heart-shaped low near the eastern margin and nearby smaller areas of low to the south and southwest were attributed to Palaeoproterozoic (~1.91 Ga) garnet leucogranite and monzogranite (Berman et al., 2015b,c). Berman et al. (2015b) proposed that the leucogranite associated with the central low may have formed by melting of Rae margin sediments and potentially could delineate a suture marking the edge of the Rae craton. Crust associated with the magnetic high immediately west of the heart-shaped low was designated the eastern plutonic belt (Berman et al., 2015b), and is associated with mainly Palaeoproterozoic diatextite and migmatitic Fe-rich metasedimentary rocks. The high is separated from an adjacent high to the west by a relatively weak, but nevertheless distinct, narrow north-trending low. The low is related to monzogranite and granodiorite metaplutonic rocks, and the high to a metaplutonic domain composed of orthopyroxene-bearing monzogranite-granodiorite and lesser amounts of diorite (Berman et al., 2015c). Together these two rock assemblages constitute the MesoArchean Duggan Lake domain (Berman et al., 2015b). Immediately west of the principal central low, where the domain is widest, a distinct north-trending belt of magnetic field highs was interpreted in terms of a metaplutonic domain dominated by Palaeoproterozoic monzogranite-granodiorite with lesser diorite to quartz diorite (Berman et al., 2015c). This was named the central plutonic belt by Berman et al. (2015b). Between this belt and western boundary of Domain 74, and correlating with a RTMF low, Berman et al. (2015b) defined the Ellice River supracrustal domain that includes gneissic monzogranite, a narrow ultramafic to mafic metavolcanic belt and interstratified Palaeoproterozoic psammitic rocks.

North of this central area to Queen Maud Gulf the less detailed geological map of Harrison et al. (2011) indicates most of the domain to be underlain by a Middle Palaeoproterozoic unit assigned to the Talston-Thelon orogen consisting of: granodiorite-granite; metagabbro, gabbroic anorthosite, anorthosite; tonalite; monzodiorite, syenite, pyroxenite, peridotite; undivided (i91). This unit is essentially equivalent to the Palaeoproterozoic unit of granite-monzonite-syenite (pPgr) included on the geological map of Nunavut (de Kemp et al., 2006). South of the central belt, where Domain 74 narrows, Harrison et al.'s (2011) map shows most of it to be covered by a NeoArchean unit of granite and granitoid gneiss and a range of plutonic rocks that include acidic, intermediate, mafic and ultramafic varieties (i54).

Domain 75 (Figures 13, 14): Domain 75 extends northward for approximately 400 km from the McDonald Fault, and falls within the Thelon tectonic zone (Berman et al., 2015b; Pehrsson et al., 2014a,b) along the northwestern edge of the Rae craton. The domain is very well defined by a singular prominent positive RTMF anomaly virtually along its entire length. It is broadest over the first 230 km from the McDonald Fault ranging in width from about 21 km to 33 km. Beyond 230 km the domain is wedge-shaped and the magnetic high gradually narrows northwards, in places split by a narrow linear longitudinal magnetic low. The domain is characterized by many linear derivative magnetic highs, many parallel to sub-parallel and generally closely spaced. Orientations vary generally between roughly north-northwest and north-northeast.

Some noticeable linear derivative magnetic lows cut across Domain 75 at orientations varying from about N20°W to N32°W coinciding with sinistral displacements of the domain boundaries, those along the western boundary being particularly large. These lows are obviously related to faults, as described by Thomas et al. (1976).

At its south end, south of 64°N, the domain correlates mainly with a unit of granite, tonalite and quartz monzodiorite to diorite (PTg) of the Thelon tectonic zone (Pehrsson et al., 2014a,b). The northern half of the domain, covered by the map of Berman et al. (2015b), correlates closely with the western plutonic belt of the Thelon tectonic zone consisting of approximately 2.01 Ga to 1.99 Ga quartz diorite to monzogranite, with K-feldspar megacrystic granodiorite dominating. In the intervening terrain between these two areas the domain coincides with Middle Palaeoproterozoic granodiorite-granite; metagabbro, gabbroic anorthosite, anorthosite; tonalite; monzodiorite, syenite, pyroxenite, peridotite; undivided (i91) of the Talston-Thelon orogen (Harrison et al., 2011).

Discussion

Images of the RTMF and related derivatives (1st vertical derivative and tilt angle) derived from aeromagnetic data collected for Canada's National Aeromagnetic Program have been used to divide the Rae craton and some marginal areas into 75 magnetic domains. These serve as a proxy for structural domains, providing a geophysical perspective on the internal structural fabric of the craton, and on more local scales, frameworks for further detailed geological mapping and investigations. Relationships to geology are examined and described, providing a guide on the significance of specific magnetic features for the mapped geology, and in cases raising questions relating to particular geological features. The descriptions note magnetic anomalies that may signify: (1) the presence of unmapped iron formation or small igneous intrusions, (2) geological units that are thin, (3) gradational relationships between adjacent geological units, and (4) geologically unmapped internal heterogeneity within units, presumably relating to the broad scale of mapping in many areas.

In addition to relatively local aspects of structure and lithological composition, the magnetic domain map has relevance to regional aspects of the tectonic development of the craton. The craton has been divided longitudinally into two elements (Fig. 1): the 2.5 – 2.3 Ga Arrowsmith orogen forming roughly the northwestern half of the Rae craton, and the southeastern remainder of the craton, including the Chesterfield block, that bears the hallmarks of significant structural and metamorphic reworking during the 2.56 – 2.50 Ga MacQuoid orogeny (Berman et al., 2013). Both orogenies are attributed to long-lived accretionary margins on the flanks of the craton, with evidence on southern Boothia Peninsula supporting an Andean-type accretionary margin setting for the Arrowsmith orogeny (Berman et al., 2013).

By analogy with the generally linear aspect of Andean geology with sub-parallel, belt-like geological units often extending over several hundreds of kilometres, units within the Arrowsmith orogen would likewise be expected to display a linear pattern. There are indeed areas of sub-parallel, linear geological units throughout this orogen. The largest area extends from the Thelon tectonic zone to the east side of the Melville Peninsula, with trends varying between roughly east-northeast and northeast (Fig. 1). Trends within the central part (southwest to northeast sense) of the orogen are hidden beneath the Thelon basin, but linear geological units trending northeast are observed southwest of the basin, particularly along the Manchester Lake – Howard Lake shear zone. These areas of linear geological units, perhaps not surprisingly, are characterized by magnetic domains displaying the same general linear patterns. The domains are belt-like and generally oriented along the trend of the Arrowsmith orogen.

The portion of the boundary of the Arrowsmith orogen southwest of the Thelon basin does not coincide with any singular geological feature, though segments lie close to a portion of the Black Bay fault (Fig. 3), and to a significant portion of the eastern boundary of a moderately large unit of Archean granulite grade amphibolite (Amvg) (Pehrsson et al., 2014a,b). Likewise, northeast of the Thelon basin it does not correlate with any particular geological feature. While exhibiting sub-parallelism with several northeastward-trending geological units it cuts across several other unit boundaries at high angles. It is sub-parallel to magnetic domains northeast of the Amer shear zone, but transects domain boundaries south of the shear zone. Noticeably it cuts across the prominent east-west belt of positive magnetic field defining Domain 39 that together with Domains 42, 36 and part of Domain 38 defines an east-west belt of magnetic highs extending for about 530 km. This belt lies partly along the Amer and Wager Bay shear zones, which postdate the Arrowsmith orogeny. Sanborne-Barrie et al. (2002) reported that the Amer zone had an early ductile history between ca. 1.85 Ga and 1.83 Ga, whereas the Wager Bay shear zone cuts 1808 ± 2 Ma granite, thus providing a maximum age of ductile, dextral strike-slip shear.

The large scale linear pattern of magnetic domains associated with the Arrowsmith orogen, apparently, is consistent with its development along an Andean-type continental margin. However, in the southeastern half of the Rae craton affected by the MacQuoid orogeny, the degree to which the pattern of magnetic domains supports a similar tectonic model is not clear. Whereas some linear geological units are present in some areas of the Chesterfield block and along part of the Snowbird tectonic zone near Snowbird Lake (Figs. 2, 3), they are absent throughout much of the southeastern Rae craton. This aspect of the geology is reflected in the shapes of the magnetic domains, which east of the Thelon basin and south of the Amer and Wager Bay shear zones (Chesterfield block excepted), in particular, lack linearity and are irregular in shape with maximum dimensions having various orientations, some directed across the craton. The absence of a strong craton-parallel linearity in the magnetic domains suggests that an Andean tectonic analogue for development of the southeastern portion of the craton is debatable.

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